The RUBBER AGE

July, 1944

TECHNOLOGY DEPT.

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DETROIT

SHORTER CURES
OF
GR-S Stocks

Mold Turn-over can be greatly INCREASED by the use of the NEW copper accelerators **CUMATE** and **CUPRAX.**

These quicker curing GR-S stocks are not scorchy and their aging is good.

CUMATE and **CUPRAX** are available in quantity.

R. T. VANDERBILT CO., INC.
230 Park Avenue, New York City

Newsletter No. 7
JULY, 1944

Published by Rubber Chemicals Division of DUPONT

BREAKDOWN GR-S WITH RPA No. 5

NOW that production of GR-S is rapidly approaching the goal set by the Office of the Rubber Director, the problem has arisen of processing it into finished products in satisfactory volume to meet requirements. The plastication, mixing and processing efficiency of GR-S on conventional rubber equipment has been variously reported as 50% to 90% of that of natural rubber. Regardless of exactly what the average figure is, it is obvious that to date smaller quantities of GR-S products have been manufactured with a given amount of equipment than could be made from crude rubber.

RPA No. 5 is a chemical peptizing agent which speeds the breakdown of GR-S and helps close the gap between GR-S and rubber in processing efficiency.

RPA No. 5 is a clear light tan colored liquid which, when added to GR-S during mastication, has the following desirable effects:

1. Reduces mastication time necessary to reach a given plasticity or degree of softness.
2. Inhibits the tendency of plasticized GR-S to recover its original toughness during storage.
3. Speeds the rate of incorporation of fillers when mixed on a mill or in the Banbury Mixer.
4. Reduces power consumption.
5. Reduces mixing temperatures to produce safer processing, higher quality stocks.
6. Produces softer stocks which have improved calendering and tubing properties.

AMOUNT OF RPA No. 5 TO USE—The proper amount of RPA No. 5 to use depends on such factors as (1) the type of mastication equipment employed, (2) the properties of the particular GR-S in question and (3) the end results desired. For most purposes we suggest the use of the amounts indicated below:

MASTICATING EQUIPMENT	% RPA No. 5 on GR-S
Mill	1 —2%
Banbury	0.5 —2%
Gordon Plasticator .	0.25—1%

IMPROVED EQUIPMENT EFFICIENCY—The practical advantages of plasticizing GR-S with RPA No. 5 have been widely demonstrated by both laboratory and factory tests. The following excerpts from test reports are typical illustrations of the effectiveness of RPA No. 5:

1. GR-S was masticated, following which a master batch of 66 pounds of GR-S and 33 pounds EPC black was mixed on a 30-inch mill at a temperature of 125° F. The following tabulation compares the RPA No. 5 treated batch with a control.

	Control No RPA	2 % RPA No. 5
Mastication time to form smooth band (minutes)	6	3
Mixing time to add black (minutes)	13	8
Total time . .	19	11
Plasticity-Recovery (Williams) .	204-75	170-61

The use of RPA No. 5 produced a saving in mastication time of 50% and a saving in total time of 42% over the control.

2. Using GR-S broken down in a Gordon Plasticator, tread stocks were mixed in a No. 11 Banbury Mixer. When 2% of the RPA No. 5 was added with the GR-S in the Banbury Mixer, the resulting stock had lower plasticity and extruded slightly faster than the control stock, even though the remilling operation on an 84-inch mill was omitted in the case of the RPA treated stock.
3. GR-S plasticated with 0.5% RPA No. 5 in one pass through a Gordon Plasticator had a Mooney viscosity equal to a control plasticized in two passes through the Gordon Plasticator without RPA No. 5.

A carcass type stock mixed in a No. 11 Banbury utilizing GR-S plasticized with RPA No. 5 had a lower discharge temperature, consumed less power and had slightly lower plasticity than the control.

	Control	0.3% RPA No. 5
Passes through Plasticator .	2	1
Ammeter readings on Banbury .	50-37	47-35
Discharge temperature of stock °F.	218	213
Mooney plasticity of final mix .	31	29

There was no difference in the way the two stocks handled on the calender.

EFFECT ON CURE—Experimental data are non-conclusive as to the effect of RPA No. 5 on the properties of vulcanized GR-S stocks. There are indications that stocks accelerated with Thionex, MBT, MBTS or DPG are slightly retarded by 1 to 2% of RPA No. 5. With activated accelerators such as SRA No. 2, Zenite B, MBT-DPG and 2-MT Accelerator 808, the vulcanizates have slightly lower modulus and hardness, equal tensile strength and higher elongations at break. With only 0.5% of RPA No. 5 there is essentially no effect.

When as much as 2% RPA No. 5 is used, an increase of approximately 5% in accelerator content will generally produce stocks having essentially the same curing characteristics as the control.

HEALTH HAZARDS—Although experience to date indicates that it is less likely to cause dermatitis than either RPA No. 2 or RPA No. 3, which have been widely used in the industry, we recommend following the same precautions as with the other RPAs. Workmen should wear long sleeved shirts and gauntlet gloves, and should wash thoroughly any parts of the body exposed to RPA No. 5.

DUPONT

RUBBER CHEMICALS DIVISION

BETTER THINGS FOR BETTER LIVING . . . *Through Chemistry*

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ANOTHER HYCAR SERVICE FEATURE

TO keep our customers informed on the latest developments in Hycar processing, the Hycar Blue Book has been distributed to interested technical executives and supplemental material for this book will be furnished from time to time. Sections and groupings in this loose-leaf book have been arranged to make it easy to insert this additional information.

Through the Blue Book, we are providing another service that will keep our customers up-to-date in the rapidly expanding field for Hycar.

We regret that, due to paper shortages, it is necessary to make certain restrictions in the distribution of the Hycar Blue Book. Every effort will be made to fulfill all requests for the Blue Book to take care of actual requirements of Rubber Companies and organizations directly serving the Rubber Industry. *Hycar Chemical Company, Akron 8, Ohio.*

Hycar

Reg. U. S. Pat. Off.

LARGEST PRIVATE PRODUCER OF BUTADIENE TYPE

Synthetic Rubber

Correct pronunciations and meanings of commonly used synthetic rubber names and terms are given in the new pocket-size Hycar Glossary. Write for free copy.

PHILBLACK A

Can Save 1 Milling Operation

This new HMF black is so successful in reducing "nerve" in synthetic rubber that a better breakdown can be obtained with less milling.
In addition, Philblack A offers:
• LOW HYSTERESIS
• HIGH RESILIENCE
• HIGH TENSILE STRENGTH
• HIGH ABRASION RESISTANCE

The properties and advantages of this new and different type black are completely presented in a new booklet "PHILBLACK A". Write or wire for this booklet, prices, availability, and samples.

PHILLIPS PETROLEUM COMPANY
Philblack Division

FIRST CENTRAL TOWER • AKRON, OHIO

FROM GEON may be made a wide variety of thermoplastic elastomers which can be extruded, pressure or injection molded, calendered, cast into sheet and film, or used as coatings for fabric and paper.

GEON, properly blended, will impart some of its characteristics to certain synthetic rubbers. Or, a different type of product with certain desirable characteristics may be made when the synthetic rubber is used as a plasticizer for GEON.

The following properties in various combinations may be found in products of GEON:

Flexible	Wide range of colors and luster
Waterproof	Electrical insulation
Light weight	Odorless
High tensile strength	Wide hardness range
Easily embossed	

Resistance to

Acids	Foods	Mildew
Alkalies	Light	Cold
Chemicals	Air	Heat
Oil	Aging	Abrasion
Gasoline	Flame	Sticking

Already many new — and, in some cases, revolutionary — uses have been found in such fields as extrusion and molding, electronics, metals, textile, paper, packaging, rubber, food and beverage, and many others in which a seemingly limitless number of uses is yet to be discovered.

Does all this suggest some new product or application or use to you? Our research staff and laboratory facilities are ready to help you. *For answers to your questions or for help on specific problems, write*

Dept. K-2 CHEMICAL DIVISION
The B. F. Goodrich Company
ROSE BUILDING E. NINTH & PROSPECT CLEVELAND 15, OHIO

★ ★ ★

GEON is available to industrial users subject to allocation under General Preference Order M-10. Limited quantities can be had for experiment.

CLIMCO

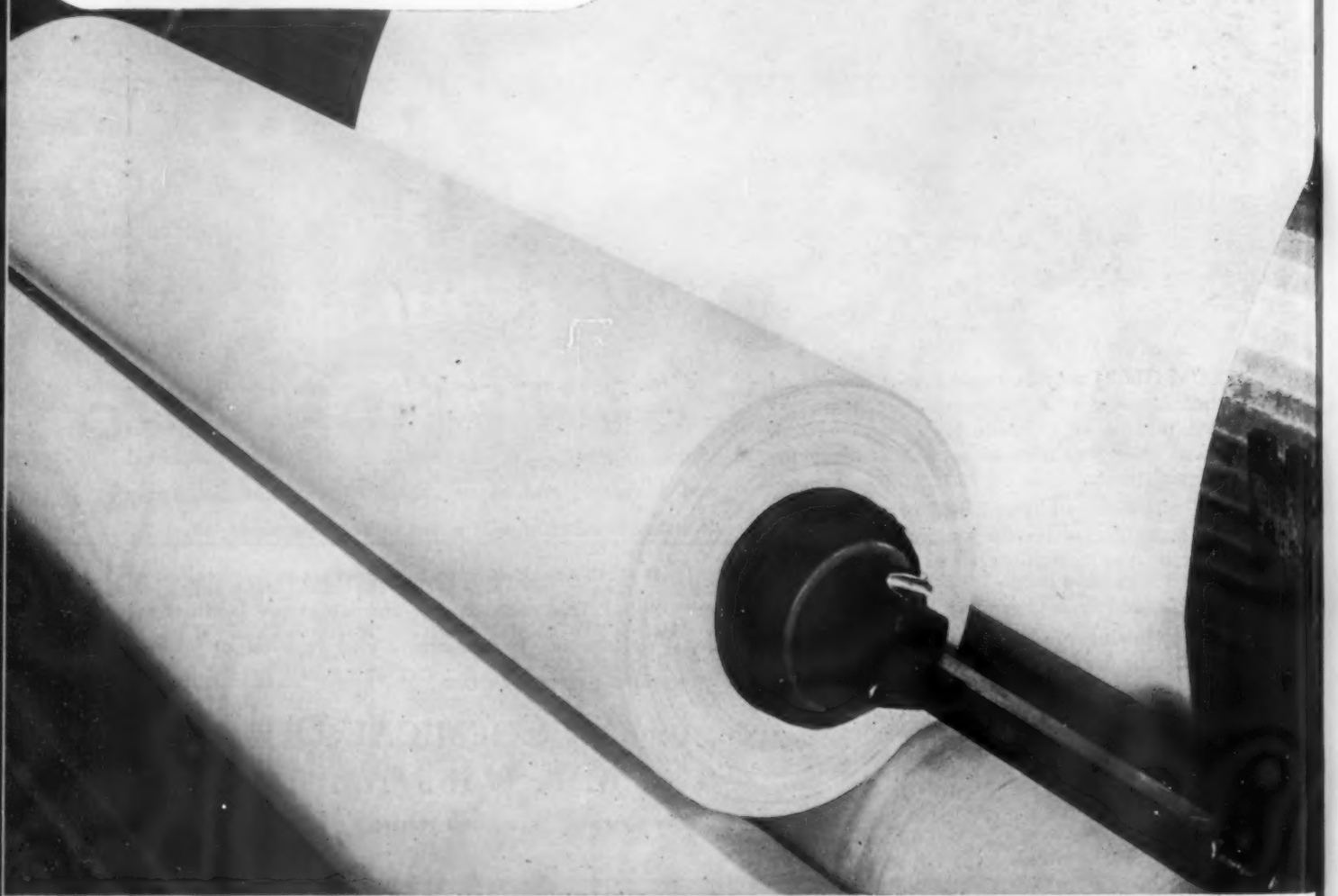
Craftsmanship

This workman, with 17 years of experience, is inspecting liner fabric for possible imperfections before it is Climco Processed. ● Such skill and experience are widespread throughout our plant, and help explain why most leading rubber companies have standardized on Climco Processing. Climco Processing insures better separation, prevents stock adhesions, eliminates liner cleaning and repairs, and greatly increases the life of liner fabric. ● Today, you can't afford to experiment. Protect your liner fabric with processing of *proven* quality—have them "Climcoed".

THE CLEVELAND LINER & MFG. CO.

CLEVELAND, OHIO

CLIMCO



CLIMCO PROCESSED LINERS

or Faster, Better Production at Lower Cost

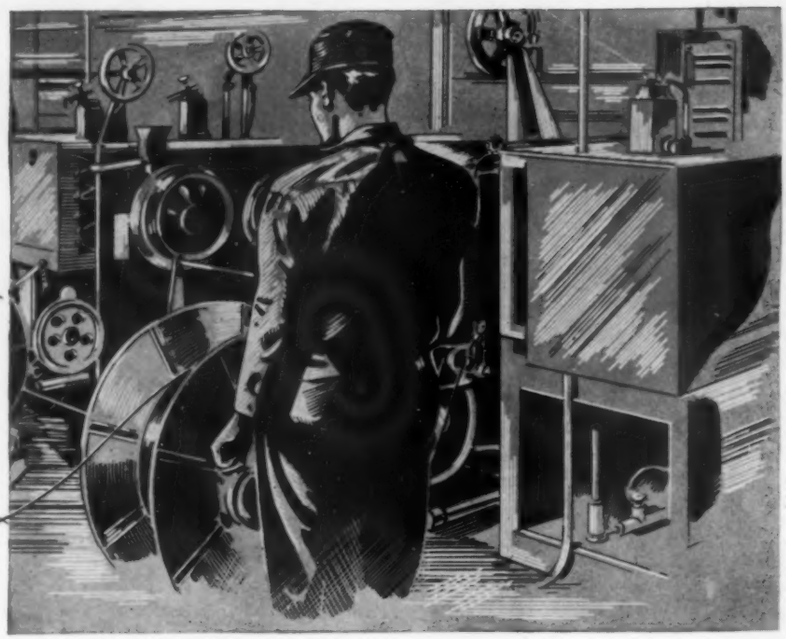
LINERETTE
INTERLEAVING PAPER
Treatment Contains
NO OIL OR WAX
Samples on Request

PLASTICIZER—EXTENDERS
NAFTOLEN R-100
A high quality product of proven merit for exacting compounding problems.
MULTI-PLAST MV
A medium priced quality product for general compounding.
MULTI-PLAST HV
A high viscosity product for special processing and compounding problems.
ECONO-PLAST
A low cost product for compounding at low volume cost.
Introducing...
THE WILMINGTON
Group
EMULSION
NAFTOLEN EMULSION
A stable emulsion of Naftolen in water designed for use with natural and synthetic rubber latices.
FILLER—PLASTICIZER
NAFTEX
A combination of SRF Black and Naftolen designed to reduce milling time and mitigate dust problems.
REINFORCING PLASTICIZER
WILMEX M
A plasticized hard hydrocarbon of the Gilsonite type for easy milling and good dispersion.
Watch for additions to the Wilmington Group
W
C=C
REG. U.S. PAT. OFFICE

WILMINGTON CHEMICAL CORPORATION

10 East 40th Street, New York 16, N. Y.

An old idea, with a new twist in the WIRE BUSINESS...



A CATALOG that lists and describes National-Standard's steel wires, braids and tapes couldn't possibly picture the policies of the company. We believe these policies are as important as the products our company produces.

Many years of experience in the rubber industry has taught us that all customer problems cannot be treated alike—individual requirements cannot always be met with a fixed line of products and specifications.

The men of National-Standard have much deeper interests than mere catalog-type of selling. Their responsibilities do not end with the delivery of a product.

These men are constantly working with tire and hose engineers and mechanical goods men to not only improve their own products, but also those of the customer and to also find new and better methods of application.

It is this kind of cooperation and personalized service, and the willingness to be helpful that has built for National-Standard a reputation with the rubber industry as a reliable source for research and engineering assistance as well as for quality products.

If you've got a problem to solve, or an idea requiring a new use of steel wire, braids or tapes for rubber reinforcement, National-Standard's experienced engineering staff is ready to serve you.

NATIONAL STANDARD Company

Divisions of National-Standard Company

NATIONAL-STANDARD
Niles, Mich.
TIRE WIRE, FABRICATED BRAIDS AND TAPE

ATHENIA STEEL
Clifton, N. J.
COLD ROLLED, HIGH-CARBON SPRING STEEL

WAGNER LITHO MACHINERY
Hoboken, N. J.
LITHOGRAPHING AND SPECIAL MACHINERY

WORCESTER WIRE WORKS
Worcester, Mass.
ROUND STEEL WIRE, SMALL SIZES

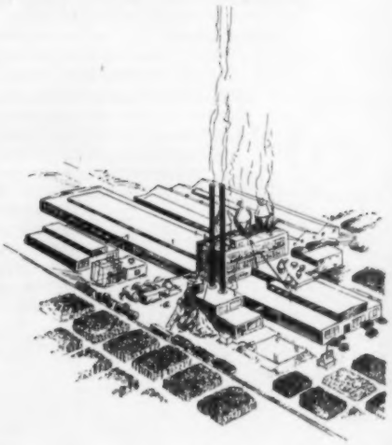
BACK THE ATTACK—BUY MORE WAR BONDS

Midwest Announces...

A NEW RESEARCH LABORATORY

Now... Two plants devoted to Maximum Production for War Requirements

Plus... Research facilities for development of Present and Post-War Reclaiming of Natural and Synthetic Rubbers.



MIDWEST RUBBER RECLAIMING CO.

East St. Louis, Ill.
East 7400

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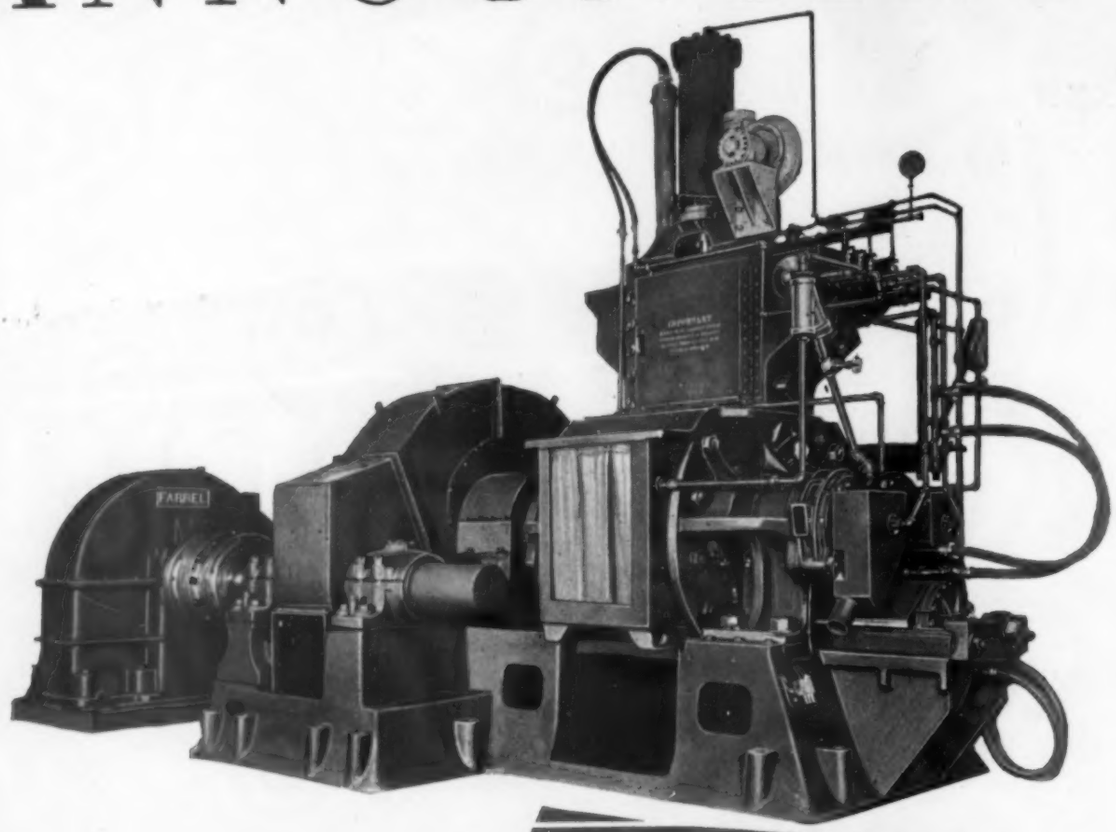
Barberton, Ohio
Sherwood 3131

ANNOUNCING



FARREL-BIRMINGHAM COMPANY, Inc.
of Ansonia, Connecticut
takes pleasure in
ANNOUNCING
an extensive program
for the handling of
all necessary
OVERHAULING, REPAIRING AND REBUILDING
of worn
BANBURY MIXERS

A NEW PROGRAM FOR HANDLING BANBURY REPAIRS

The Rubber Director's Office in Washington has now granted us permission to return our facilities to the handling of necessary Banbury Mixer repairs.

Heretofore we have been unable to take care of as much of this work as we should like because of limitations imposed upon us by the government. The result has been that a considerable volume of repair work has been done by concerns not properly equipped by knowledge, experience or facilities to handle it.

Under this new program we are prepared to:

1. Send an experienced man to examine and report on the condition of your Banburys.
2. When necessary, return the entire body of the mixer to our plant, where it will be completely overhauled and needed repairs and replacements made.
3. Stand back of all repair work the same as we do on a new machine.

In making use of our facilities, you will know that repairs are being made by:

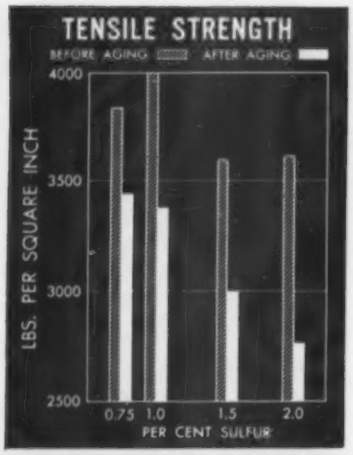
1. The developer and manufacturer of the Banbury Mixer.
2. The only company which has complete drawings showing original dimensions.
3. The only company having the necessary jigs and fixtures.
4. The only company with an adequate knowledge of Banbury requirements.

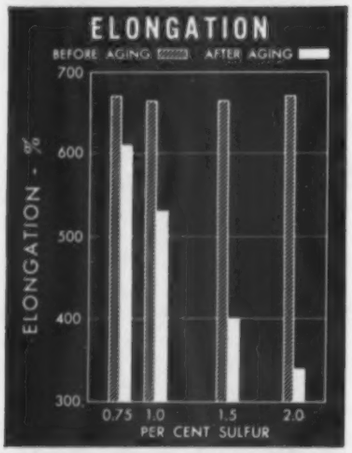
If you are in doubt as to the condition of your Banburys, call in one of our representatives. You will receive unbiased advice from a man who understands the basic design principles of the machine. Preliminary inspections will be made without cost or obligation.

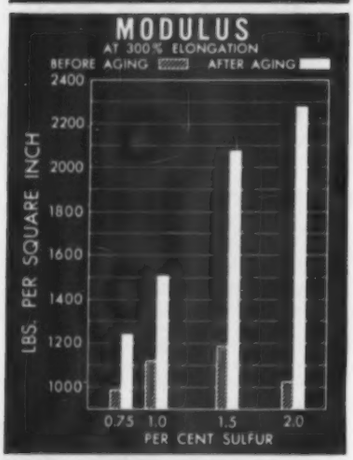
FARREL - BIRMINGHAM COMPANY, Inc.

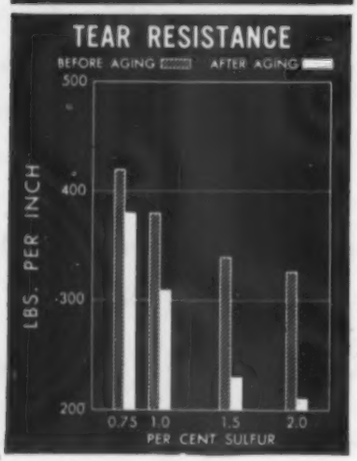
ANSONIA, CONN.

PLANTS: Ansonia and Derby, Conn., Buffalo, N. Y. • SALES OFFICES: Ansonia, Buffalo, New York, Pittsburgh, Akron, Los Angeles









Give your GR-S Compounds heat stability provided by low sulfur content

Safe, fast curing now made possible by FBS LITHARGE

As you know, reduction in sulfur content means increase in heat stability.

It has now been demonstrated that FBS litharge (plus benzothiazyl disulfide) makes low sulfur formulas practicable.

Why?

Because it speeds up greatly the rate of cure without increasing the risk of scorching.

Thus, even though the normal quantity of accelerator is used, *the sulfur content can be reduced.*

Note, in the series of tests charted and tabulated, the superior behavior of the 0.75 and 1.0 sulfur formulas.

FORMULA

GR-S (Institute)	100
E.P.C. Carbon Black	50
Zinc Oxide	3
Coal tar softener	5
Benzothiazyl Disulfide	1.0
FBS Litharge	1.5
Sulfur	variable

Effect of Varying Amounts of Sulfur on Physical Properties

(Curing period: 20 min. Temp: 287° F.)

% Sulfur	*Tensile Strength*	*% Elongation*	*Modulus at 300% Elong.*	*Tear Resistance*
0.75	3840	670	980	420
1.0	4000	665	1120	380
1.5	3600	665	1190	340
2.0	3620	670	1025	325
After Aging 24 Hours at 100° C.				
0.75	3460	610	1240	380
1.0	3380	530	1510	310
1.5	3000	400	2080	230
2.0	2770	340	2280	210

CONCLUSIONS:

1. FBS Litharge-thiazole with low sulfur imparts heat stability.
2. Modulus is high and steady.
3. Elongation is retained despite exposure to heat.
4. Heat stability prevents brittleness and improves tear resistance.
5. Rate of cure is relatively fast, without tendency to scorch.
6. The combination is inexpensive and efficient.

Ask us to send you a printed report, "Compounding of GR-S for Heat Resistance," issued by the Rubber Division of our Research Laboratories, which covers the subject of FBS Litharge for low sulfur formulae in greater detail and from a number of additional angles.

NATIONAL LEAD COMPANY New York, Buffalo, Chicago, Cincinnati, Cleveland, St. Louis, San Francisco: Boston (National-Boston Lead Co.); Pittsburgh (National Lead & Oil Co. of Penna.); Philadelphia (John T. Lewis & Bros. Co.).

The C. P. Hall Co.

CHEMICAL MANUFACTURERS

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SYN-TAC

A FREE FLOWING PLASTICIZER FOR STYRENE TYPE SYNTHETIC RUBBER

IMPROVES TACK

IMPROVES DISPERSION

IMPROVES TEAR

IMPROVES ELONGATION

AKRON, OHIO • LOS ANGELES, CALIF. • CHICAGO, ILL.

ANTISOL

• A Wax for Imparting

to Synthetic Rubbers Improved

Resistance to Atmospheric Cracking

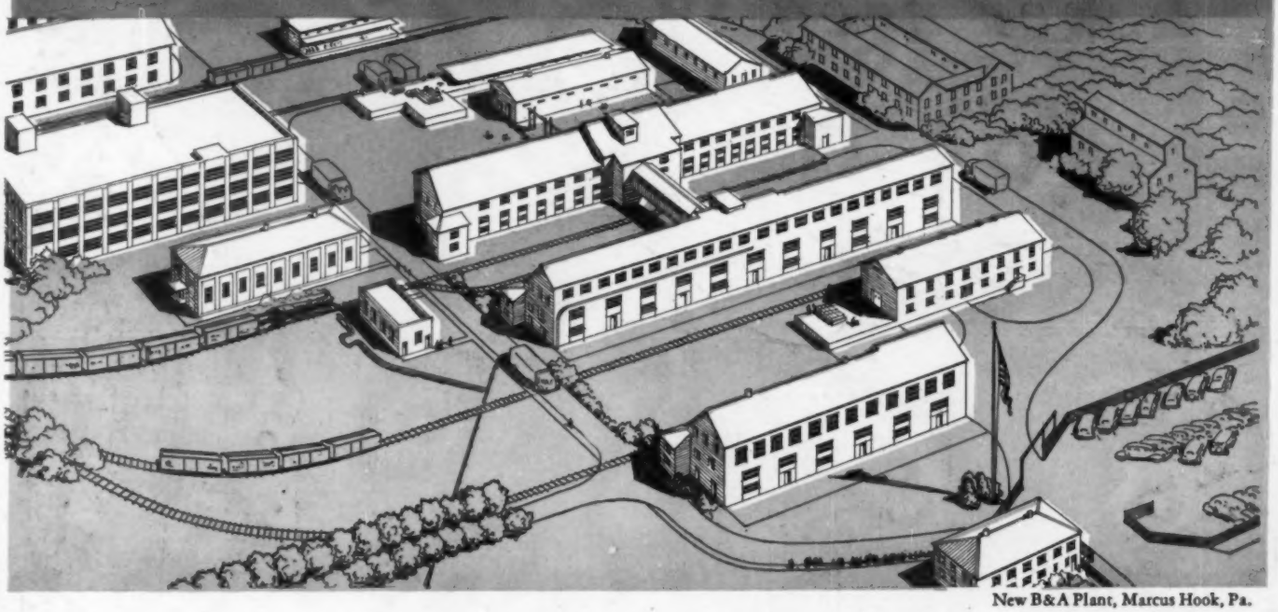
Samples and Technical Data Available

HERRON BROS. & MEYER

82 Beaver Street, NEW YORK 5, N. Y.

516 Ohio Bldg., AKRON, OHIO

AGAIN *GENERAL CHEMICAL* CREATES NEW FACILITIES FOR BAKER & ADAMSON PRODUCTS TO SERVE AMERICAN INDUSTRY!



New B&A Plant, Marcus Hook, Pa.

THESE NEW FACILITIES for production of Baker & Adamson reagent and fine chemicals provide ideal manufacturing areas, additional research and development laboratories, and special storage and shipping accommodations. This plant's output, coupled with that of other Baker & Adamson producing units and distributing stations throughout the United States, marks another forward step in Baker & Adamson leadership.

Basic materials for many Baker & Adamson quality products made here come directly from sixteen of General Chemical Company's producing locations. With such fundamental sources of supply, including many Company-owned mines for raw materials, Baker & Adamson is in a pre-eminent and unique position for meeting the expanding uses of high-purity chemicals in industry.

Whether you require laboratory reagents, fine chemicals, or other products prepared in accordance with your formulae—avail yourself of the Baker & Adamson facilities. Experienced technical service representatives are ready to discuss *your* chemical problems and requirements. Baker & Adamson stocks are carried in many principal cities!

GENERAL CHEMICAL COMPANY

Fine Chemicals for Industrial America

GENERAL CHEMICAL COMPANY

40 RECTOR STREET, NEW YORK 6, N. Y.

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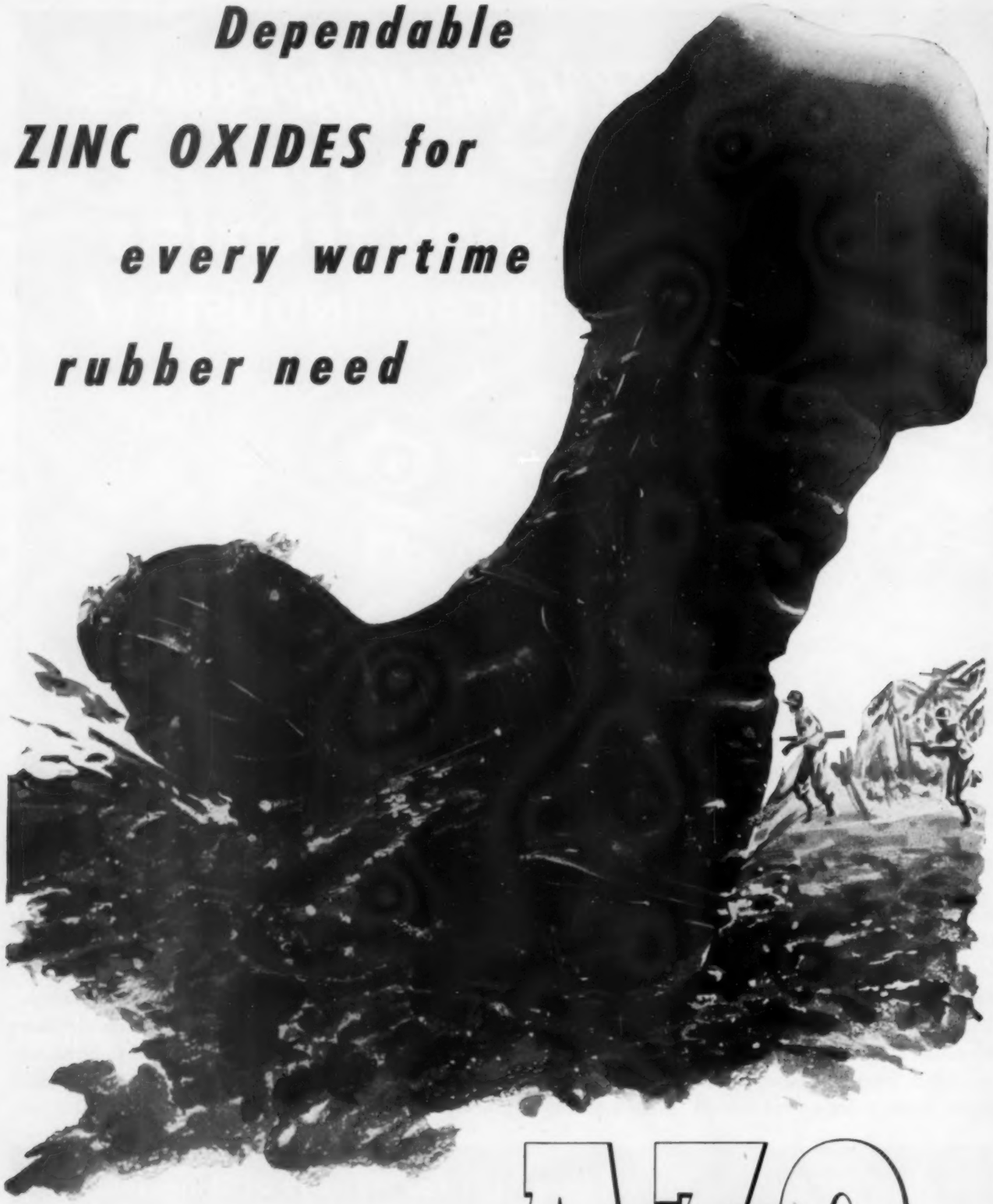
Pacific Coast Technical Service Offices:
Los Angeles • San Francisco • Seattle, Wenatchee and Yakima (Wash.)

In Canada: The Nichols Chemical Company, Limited • Montreal • Toronto • Vancouver

Dependable ZINC OXIDES for every wartime rubber need



AZO ZINC OXIDES

AMERICAN ZINC SALES CO., Distributors for AMERICAN ZINC, LEAD & SMELTING CO.

COLUMBUS, OHIO - CHICAGO - ST. LOUIS - NEW YORK

SHELL DUTREX 6

Plasticizer and Extender for GR—S

Chemically and physically Controlled

SHELL OIL COMPANY, INC.
50 WEST 50th STREET
NEW YORK 20, N. Y.

For the RUBBER Industry

A NEW TACKIFIER

PENTACIZER 344

USES: As a Tackifier and softener for synthetic rubbers

AVAILABILITY: Commercial quantities

PROPERTIES:

APPEARANCE — Brown, Resinous, Friable Powder

SOLUBLE IN — Acetone, Benzene, Linseed Oil
Buna S Types, Buna N Types

FINE HEYDEN CHEMICALS

Samples and further information upon request

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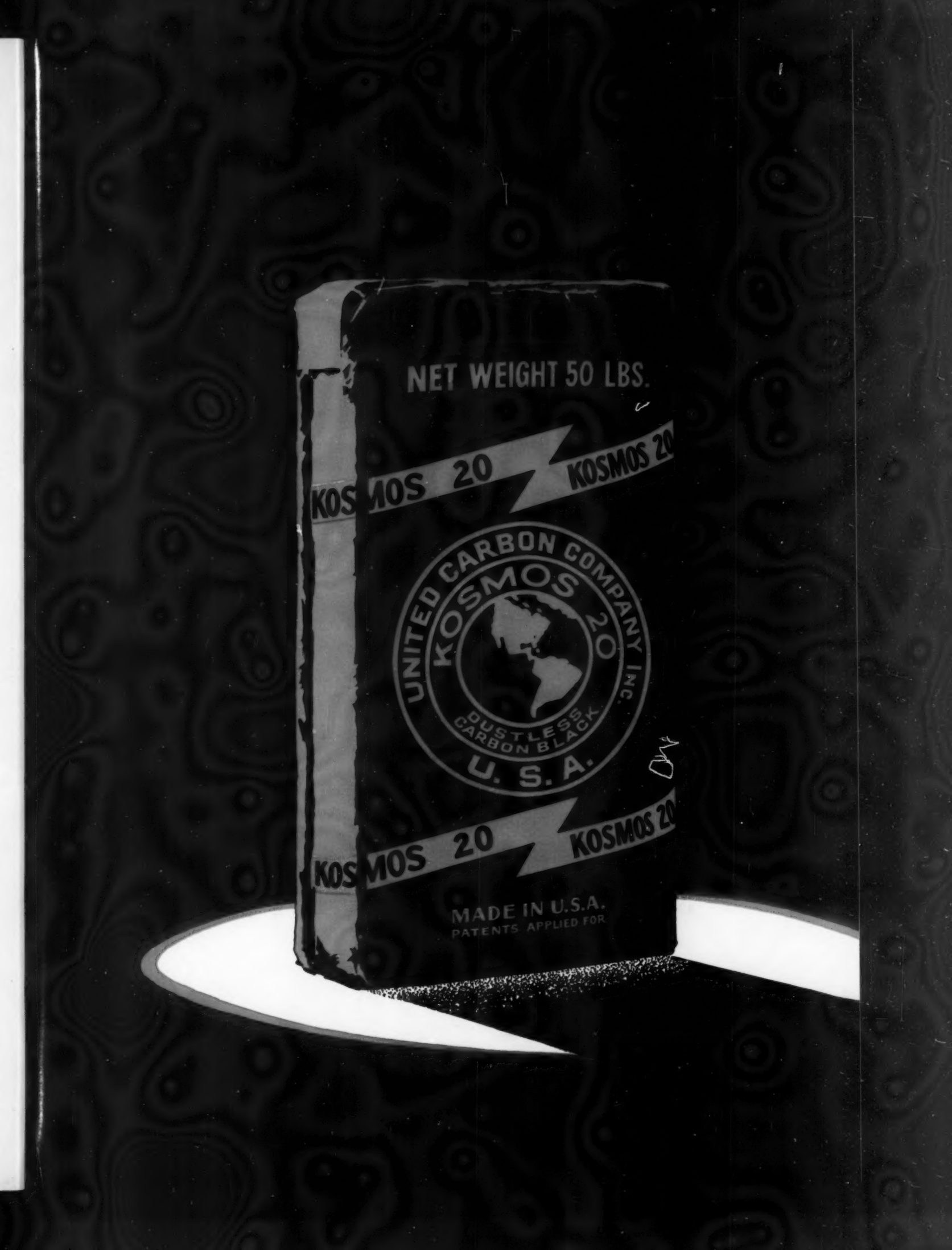

NET WEIGHT 50 LBS.
KOSMOS 20
KOSMOS 20
UNITED CARBON COMPANY INC.
KOSMOS 20
DUSTLESS CARBON BLACK
U. S. A.
KOSMOS 20
KOSMOS 20
MADE IN U.S.A.
PATENTS APPLIED FOR

KOSMOS 20

KOSMOS 20 is a semi-reinforcing (SRF) type carbon black made by United's special furnace process.

IDEAL for the GR-S and other rubbers used in military and civilian goods.

OUTSTANDING for ease of processing, good plasticity, fast rate of cure, high resiliency, and low heat build-up.

WELL-KNOWN for uniform quality and performance.

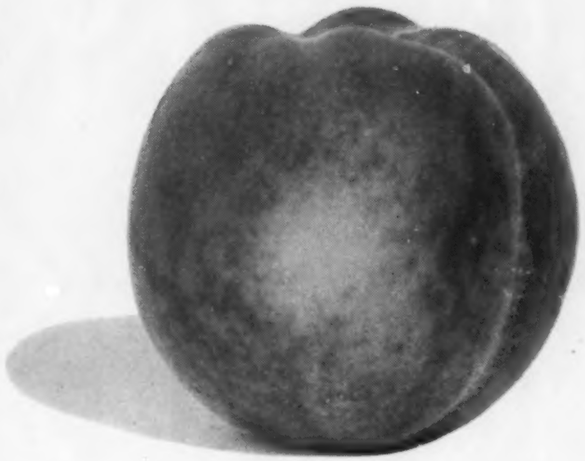
RECOMMENDED for blending with channel black for moderate reinforcement and low heat build up.

KOSMOS 20 is a Strong Rubber Favorite.

RESEARCH DIVISION

UNITED CARBON COMPANY, INC.

Charleston, West Virginia



. . . Smooth

SMOOTH is the word for the skin of a peach, but it applies as well to the action of RESINEX in GR-S compounds that are to be extruded . . . This thermoplastic Extender-Plasticizer not only softens and smooths out the stock for fast, clean-cut extrusion, but it also provides greater tensile and elongation, reduction of flex-cracking and better resistance to tear and abrasion in the finished product.

In tires, tubes, camelback, tank track, soles, heels, hose, printers' rolls and a variety of other products RESINEX is helping manufacturers greatly improve product performance and reduce production cost.

RESINEX

Write for Laboratory Facts and samples

STANDARD *Chemical Company*

General Offices: AKRON 8, OHIO

An Impartial Jury Picks

INTERSTATE

In the Case of MIXER REPAIRS

A jury of owners and users, of maintenance engineers and production superintendents, who want skillful workmanship and efficient results in mixer rebuilding, have chosen **INTERSTATE** as their headquarters for all mixer repairs. . . . Theirs is an impartial verdict based on experience.

Write, wire or phone us about your Mixer problems

SERVING THE RUBBER INDUSTRY

INTERSTATE WELDING SERVICE

Main Plant: 914 Miami Street . . . AKRON 11, OHIO . . . Phone: JE 7970

EXCLUSIVE SPECIALISTS IN BANBURY MIXER REBUILDING

PARAPLEX G-25

Oil-insoluble non-migratable plasticizer for vinyl resins and Buna-N synthetics

PARAPLEX G-25 is a radically different type of resinous plasticizer, the *first* to combine the desirable properties of ester types with the permanence characteristic of a stable, synthetic resin. Although currently most widely used with vinyl resins and Buna-N synthetics, PARAPLEX G-25 is also compatible, in varying degree, with cellulose nitrate, cellulose acetate propionate, polystyrene, chlorinated rubber, Neoprene and various other elastomers. Using PARAPLEX G-25 as the plasticizer, stocks may be formulated which exhibit these outstanding properties:

1. Resistance to oils, gasoline, and water
2. Excellent heat stability and low volatility
3. Good low temperature flexibility
4. Excellent resistance to ultra-violet
5. Very low heat deformation
6. Good electrical properties
7. Ease of extruding and calendering

PARAPLEX G-25 is not, at present, under allocation, and enlarged production makes it available for important civilian needs as well as military uses. Write today for complete information on this unique resinous plasticizer.

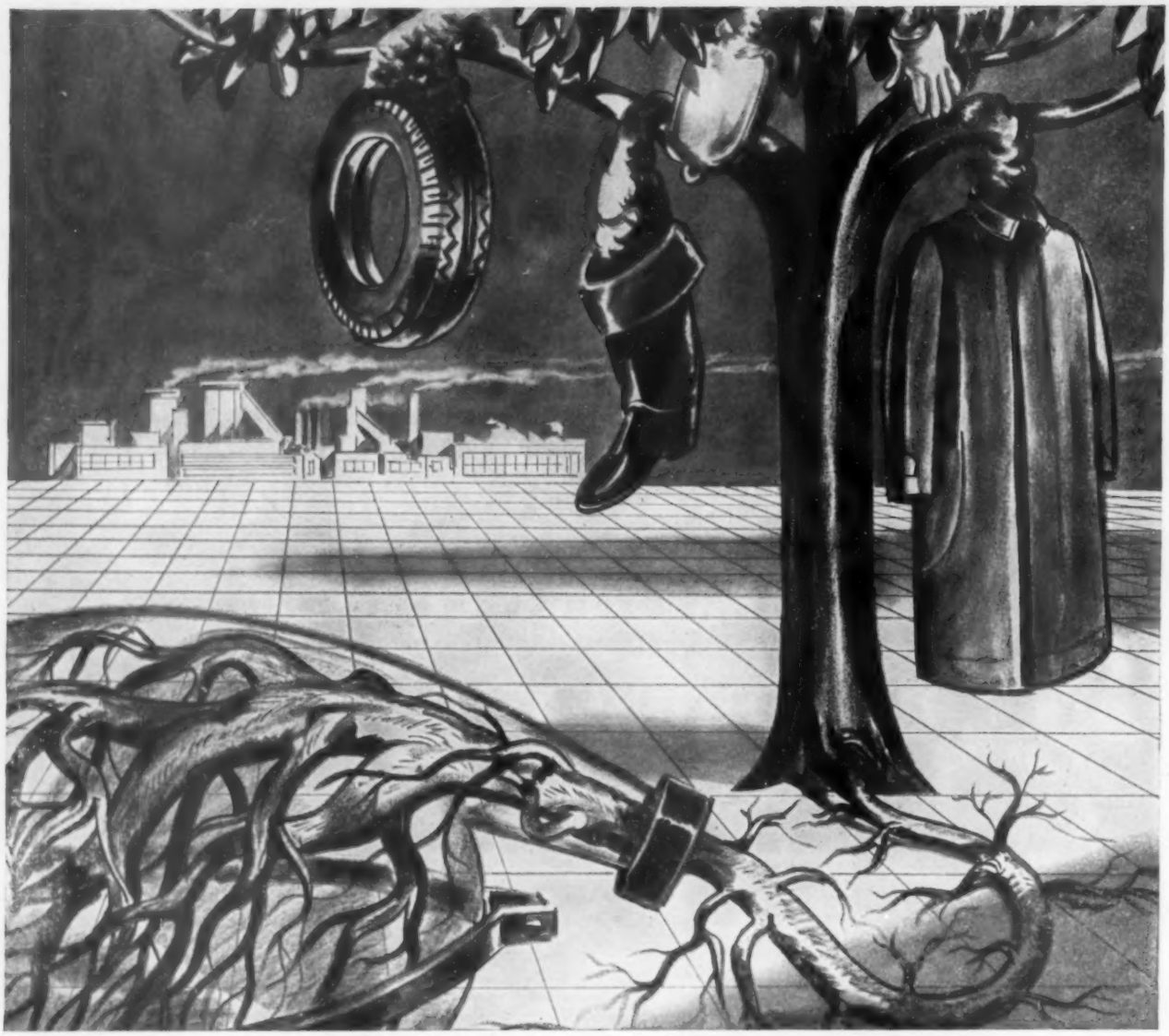
PARAPLEX *is a trade-mark, Reg. U. S. Pat. Off.*

3 awards to The Resinous Products & Chemical Company and its associated firms, Rohm & Haas Company and Charles Lennig & Company.

Represented by Cia. Rohm y Haas, S.R.L., Carlos Pellegrini 331, Buenos Aires, Argentina, and agents in principal South American cities.

THE RESINOUS PRODUCTS & CHEMICAL COMPANY

WASHINGTON SQUARE, PHILADELPHIA, PA.



STRANGE TREE

Two years ago the chemists and engineers of American industry planted a new rubber "tree". Grown from petroleum and grain, and fertilized by coal-tar, this tree will soon yield rubber at the rate of 850,000 long tons a year.

Essential to its phenomenal growth have been a group of basic coal-tar chemicals for which Barrett is a key source of supply. These chemicals are valuable in the processing of every type of rubber—synthetic, natural and reclaim—helping to make them more usable and imparting to them a wide variety of desirable characteristics.

The knowledge and experience of Barrett research chemists and engineers are available to you in adapting these chemicals to your requirements. Your inquiries will receive prompt, efficient attention.

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Barrett Rubber Compounding Materials—Carbonex* • Carbonex S • Carbonex S Plastic • Cumar* • Bardol* • Bardol* B • Dispersing Oil No. 10 • Dispersing Oil No. 64 • B.R.H. No. 2* • B.R.T. No. 3* • B.R.T. No. 7* • B.R.V.* • S.R.O. • Reclaiming Oil No. 1621 • B.R.C.* No. 20 • Resin-C-Pitch.

Barrett — *ONE OF AMERICA'S GREAT BASIC BUSINESSES*

*Trade-mark Reg. U. S. Pat. Off.

A Report to the Owners of

MORE THAN

42,665,000* Vehicles

EQUIPPED WITH

STANDARD TIRE VALVES

A SERIOUS TIRE SITUATION. Because of the critical rubber shortage, the present tires on your vehicles may be all you'll have for the duration. Because of this serious situation, they must be made to last by keeping them free from abuse and properly inflated at all times. It's a fact that a tire underinflated 6 lbs. loses up to 30% of its potential mileage.

Since Pearl Harbor new car, tire and tube production has been limited principally to military and essential war-time needs. Inner tubes equipped with Standard Tire Valves in civilian service today are, on the average, over 5 years old—with millions 10 to 15 years old. Five years and more of constant use with no apparent relief in sight means but one thing—even more wear and tear.

HERE'S GOOD NEWS ABOUT YOUR VALVES! Tire Valves are built with standardized replaceable parts—for your convenience. This standardization that began 46 years ago, is widespread throughout the world today, due to the foresight and progressiveness of the tire and automotive industry. One size valve cap and valve core will fit every one of the more than 189,000,000 standard valves in use in the United States alone. Standard caps and cores may be obtained wherever gas or tires are sold or flats repaired.

WHAT YOU CAN DO TO MAKE YOUR TIRES LAST See that every tire valve is air-tight. 1. Inspect the core to see if it is damaged and replace only if necessary. 2. Be sure that a Standard Valve Cap is on every tire valve, for if a core is damaged and you cannot get another one immediately, the cap screwed down finger-tight absolutely guarantees an air-tight valve seal. 3. If your tire still loses air excessively . . . *after* you have inflated it to the correct war-time pressure and sealed the valve with a Standard Air-tight Valve Cap . . . you know the leak is in the tube. Have the tube fixed immediately, for underinflation ruins a tire, breaks down the side walls and, as a result, the tire cannot be recapped.

To conserve vital rubber, every man, woman and child should see that a Standard Tire Valve Cap is on every valve. You can tell at a glance when one is needed. Next time you get gas—get air—get air-tight Schrader Caps.

*1943 Registration Figures

Reprints of this advertisement are available for Bulletin Boards

100th Anniversary 1844 1944

A. SCHRADER'S SON, *Division of Scovill Manufacturing Company, Incorporated,* BROOKLYN, NEW YORK

It's an old saying, but it's especially true in these days of all-out

Many hands make Light the work

war production. And it's something to remember if your rubber technicians are ever baffled by a problem of compounding synthetic rubber.

FOR SYNTHETIC RUBBER is different from the natural rubber they have known, and when trouble comes, they may need special knowledge. That knowledge we can supply—our "hands", added to your own, can make light work of almost any difficulty. So, if we can be of help, call us—and call quickly. Our scientists developed Perbunan in the Esso Laboratories of the Standard Oil Development Company. We make Perbunan from raw material to finished rubber, and our scientists and field technicians will be glad to give you the help you need. Ask for it—whenever you need it!

PERBUNAN
REG. U. S. PAT. OFF.

THE SYNTHETIC RUBBER THAT RESISTS OIL, COLD, HEAT AND TIME

Write STANCO DISTRIBUTORS, INC.
26 Broadway, New York 4, N. Y.
Warehouse stocks in New Jersey Louisiana and California

BAKER PLASTICIZERS

IMPART

1. Low Temperature Flexibility
2. Retained Flexibility

to

Vinyl Resins
Phenolic Resins
Acrylic Resins
Urea Formaldehyde Resins
Cellulose Resins
Alkyd Resins
Styrene Resins
Melamine Resins

Baker Plasticizers
Contain NO Phthalate

THE BAKER CASTOR OIL COMPANY

Established 1857

Jersey City, New Jersey
120 Broadway, New York 5, New York
Los Angeles, California
Bayonne, New Jersey

Uniformity, that most sought-after feature in industrial fabrics, is perhaps the most difficult to attain. It is not achieved through any one textile operation, but begins with the careful selection of top grades of cotton and must be controlled through every phase of fabric manufacturing. That is the reason for the broad system of laboratory control which guides every step in the production of MT. VERNON fabrics. The application of this modern method of quality control, plus the skill of more than fifty years industrial fabric-making experience, is your guarantee of a measure of uniformity in MT. VERNON fabrics which will meet your every specification.

MT. VERNON WOODBERRY MILLS, INC.

TURNER HALSEY COMPANY
Selling Agents
40 WORTH STREET * NEW YORK, N. Y.
CHICAGO · NEW ORLEANS · ATLANTA · BALTIMORE · BOSTON · LOS ANGELES · SAN FRANCISCO

EEMCO Presses

★ Made in small 12" x 12" Laboratory Press and up to all larger sizes necessary for production needs, EEMCO hydraulic presses are especially designed for rubber and plastics processing. They can be equipped with pull-back or push-back cylinders and knockouts for ejecting molded pieces, if desired. Write for quotations, giving size of platen and number of openings required for the press or presses needed.

★ ★ ★

Eastern Sales Representatives
H. E. STONE SUPPLY CO.
OAKLYN, N. J.

Mid-West Sales Representatives
HERRON & MEYER OF CHICAGO
38 SOUTH DEARBORN ST.
CHICAGO 3, ILL.

★ ★ ★

MANUFACTURERS OF MILLS • REFINERS • WASHERS • EXTRUDERS
STRAINERS • PRESSES • CALENDERS • TUBERS • CRACKERS

EEMCO — ERIE ENGINE & MFG. CO.
SUCCESSOR TO "NAGLE"
953 EAST 12th ST., ERIE, PENNA.

PELLETEX Helps Our Forces Surmount Many Obstacles

U. S. Signal Corps Photo

Rafts of synthetic rubber for ferrying troops and light equipment across rivers are playing a vital role in the march to Victory. Technicians find PELLETEX Semi-Reinforcing Furnace Black an ideal pigment for this type of service. Its remarkable uniformity and easy processing help to insure quality and dependability in the finished product.

In service as in laboratory tests PELLETEX and GASTEX have repeatedly topped all blacks for certain specific purposes. Consult our technicians. No priorities required on their services.

HERRON BROS. & MEYER

OHIO BLDG., AKRON, OHIO.

GENERAL SALES AGENTS FOR

GASTEX TRADE MARK

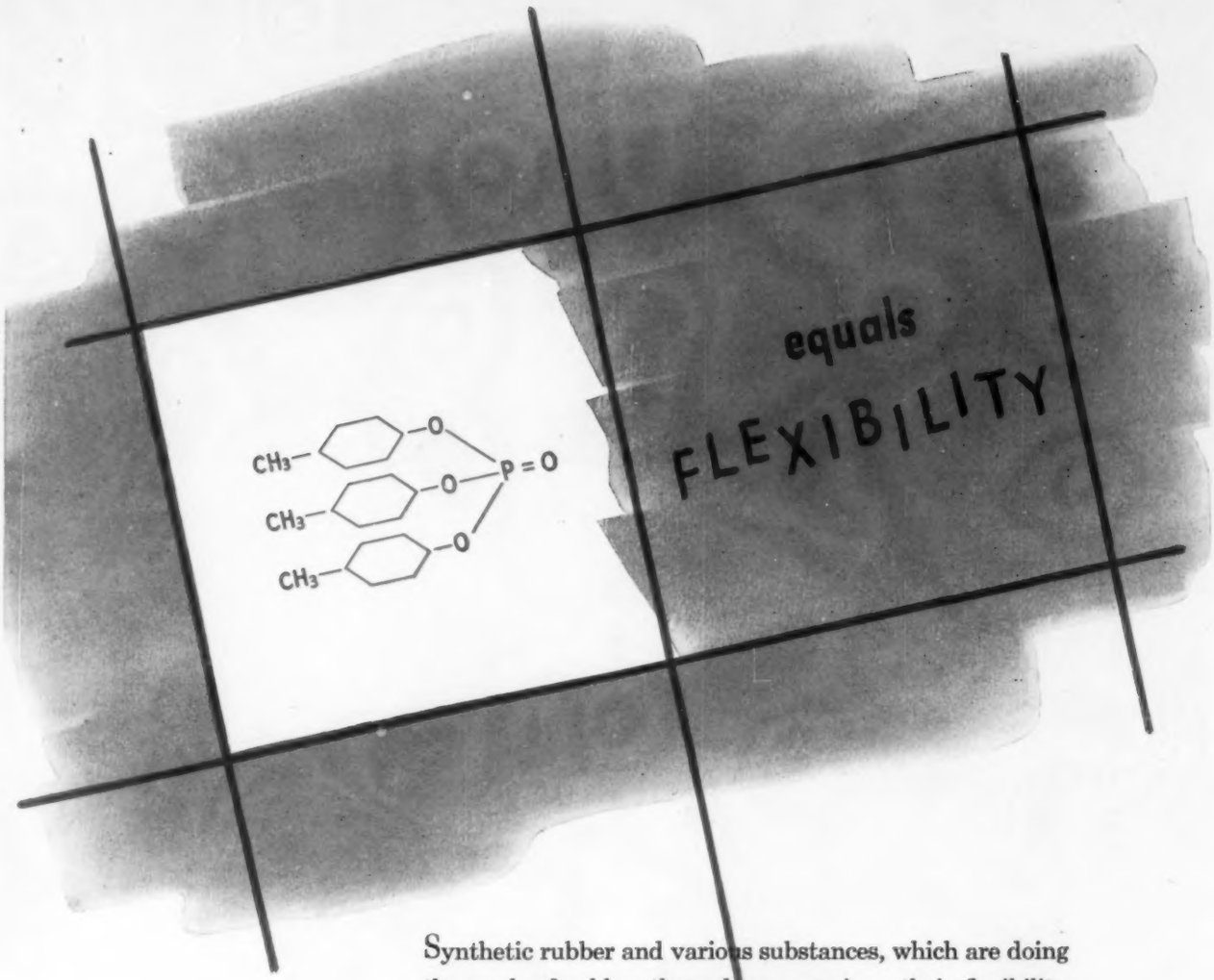
PELLETEX TRADE MARK

GENERAL ATLAS CARBON

PAMPA, TEXAS—GUYMON, OKLA.

DISTRICT SALES AGENTS

ERNEST JACOBY & CO., Boston
HERRON BROS. & MEYER, New York
THE C. P. HALL CO. OF CALIF., Los Angeles
HERRON & MEYER, Chicago
H. M. ROYAL, INC., Trenton, N. J.
ST. LAWRENCE CHEMICAL CO., LTD., Toronto - Montreal



Synthetic rubber and various substances, which are doing the work of rubber these days, are given their flexibility by Monsanto's Tricresyl Phosphate.

Tricresyl Phosphate, a clear, practically colorless liquid, is a solvent plasticizer that gives excellent fire resistance. It has a high boiling point and is relatively non-volatile, having an evaporation loss of less than 0.10% in 100 hours at 100°C.

Complete information on Monsanto Tricresyl Phosphate and other plasticizers and resins will be sent promptly upon request to the nearest Monsanto office or to MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri.

District Offices: New York, Chicago, Boston, Detroit, Charlotte, Birmingham, Los Angeles, San Francisco, Montreal, Toronto.

MONSANTO CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND

Since the inception of the rubber reclaiming industry we have met its requirements for scrap rubber expertly because of our long experience, trained organization, and extensive facilities. This background is invaluable in meeting today's demands and insures prompt and satisfactory service.

THE LOEWENTHAL COMPANY

JACK SIDER, President — **J. K. McELLIGOTT, Exec. Vice-Pres.**

We Solicit Your Inquiries

188 W. RANDOLPH ST.
CHICAGO 1, ILL.

Cable Address: "Cyblowell"

159 CLEWELL ST.
AKRON 5, OHIO

TREATED TIRE FABRICS

BUILD BETTER TIRES

Dispersions Process Inc.

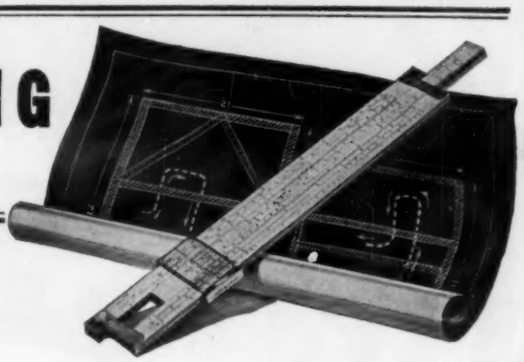
UNDER MANAGEMENT UNITED STATES RUBBER COMPANY

1230 SIXTH AVENUE, NEW YORK 20, N. Y.

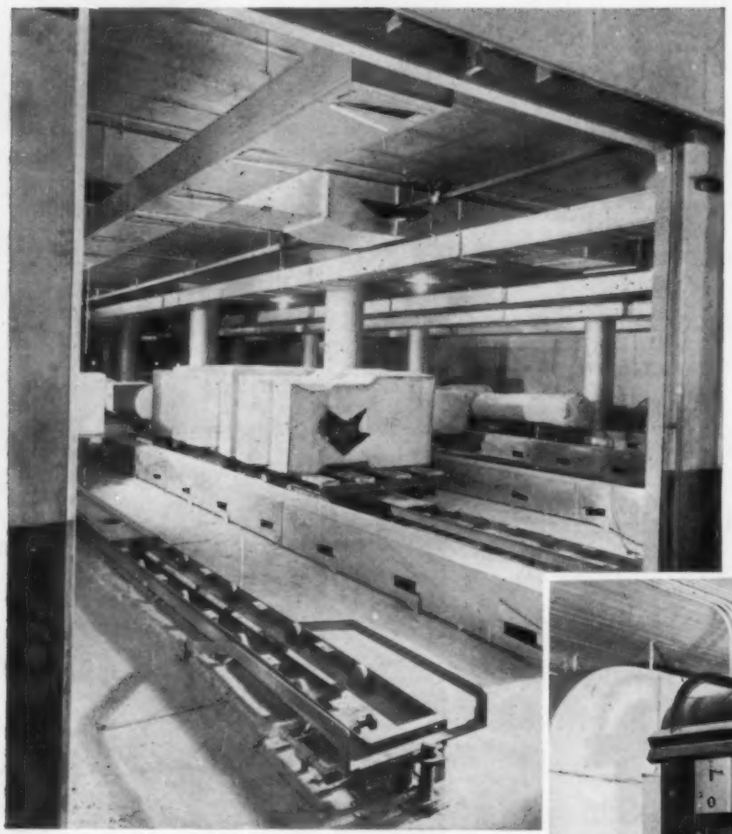
In Canada: DOMINION RUBBER COMPANY, LTD., MONTREAL

Shoe Adhesive Base Materials
We supply synthetic rubber latex compounds and dispersions of reclaimed rubber and synthetic resins to adhesive manufacturers
Naugatuck Chemical
DIVISION OF UNITED STATES RUBBER COMPANY
Dispersions Process, Inc.
UNDER MANAGEMENT
1230 SIXTH AVENUE, NEW YORK 20, N. Y.
In Canada: DOMINION RUBBER COMPANY, LTD., MONTREAL

OVEN ENGINEERING NEWS



Seven-Alley Conveyer Oven Speeds B. F. Goodrich Production Of Self-Sealing Fuel Tanks



Above is shown the curing room of the B. F. Goodrich Company's new aircraft fuel cell dryer, one of the marvels of present day oven engineering. This multi-compartment oven processing system performs three separate functions:

1. The curing of cell materials to form a semi-rigid liquid-tight structure.
2. The preheating of completed cells preparatory to finishing.
3. The baking of paint finishes on the cells.

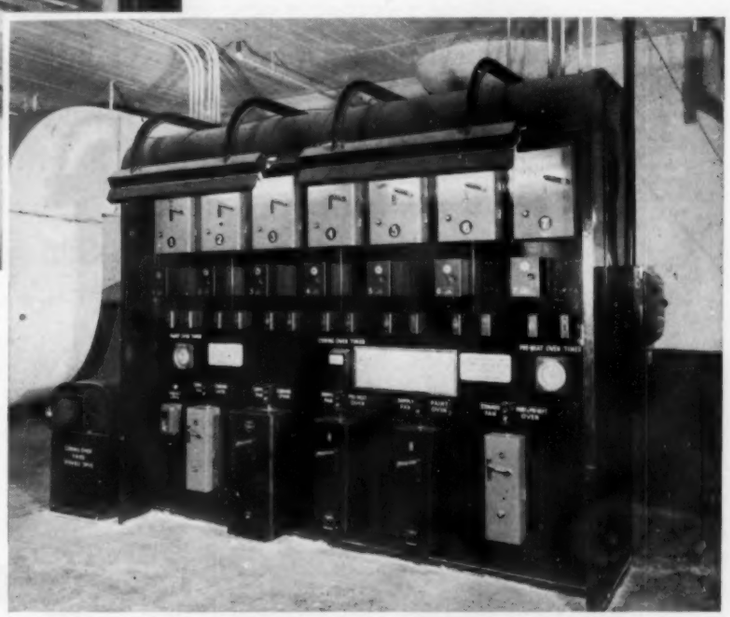
Curing is accomplished in the five open alleys of the curing room, while single enclosed alleys are devoted to the preheating and baking. Fabricating processes are carried on adjacent to the curing room, between passes, and painting is done in a spray booth at the entering end of the baking alley.

One of the largest ovens ever built, this installation encloses 147,000 cubic feet of insulated volume, the air of which is replaced approximately once a minute. With the temperature of this enormous enclosure guaranteed to $\pm 5°$, tests have revealed the actual variation to be only $\pm 3°$.

The entire system is built directly into the building and is insulated from it. Seven pusher-type floor conveyers, each extending the full 175-foot length of the oven, are operated by oil immersed mechanical reversing drives which are mounted on the ceiling of the floor beneath.

Ingenious electrical control of all conveyers makes it possible to work out production schedules in advance of actual production runs. Shown in the photograph below is the complete control system for the entire operation, designed, built and field wired by the Industrial Oven Engineering Company.

This unusual processing system is one of many different systems designed and built for a wide variety of industries by Industrial Oven. If you want to know more about this type of processing equipment, or if you have an oven problem of any other nature, just get in touch with us. For possible post-war uses of the installation pictured here, see our advertisement in this magazine next month.



(This is No. 11 of a series. Reprints of previous advertisements will be sent free upon request.)

THE INDUSTRIAL *Oven Engineering* **COMPANY**

11621 Detroit Avenue **Cleveland, Ohio**

ENGINEERING VERSATILITY

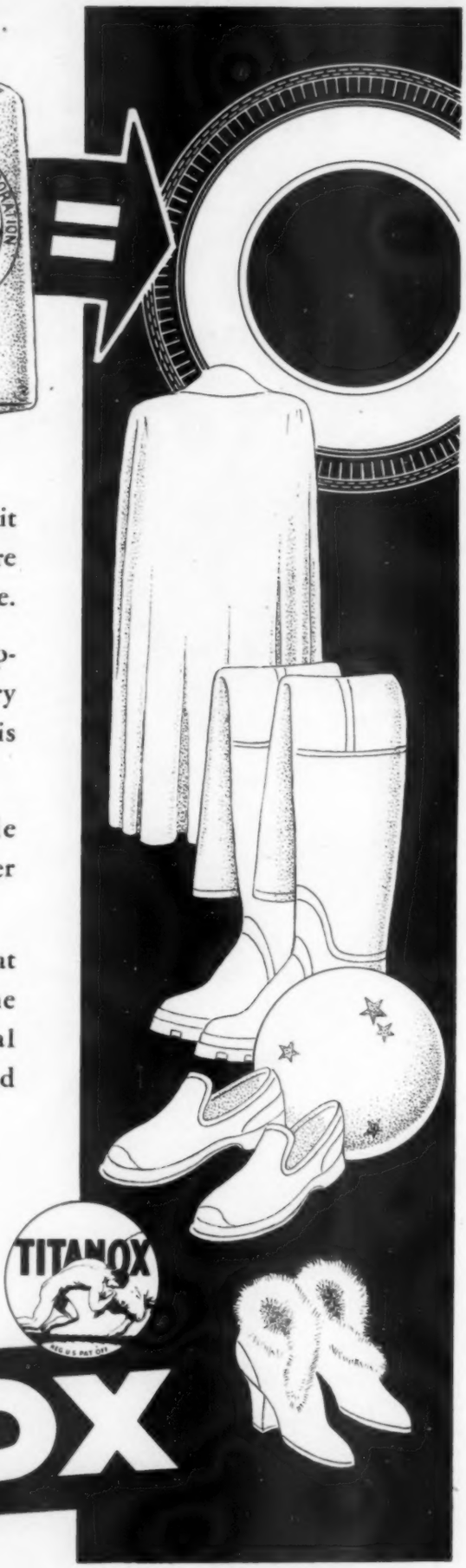
TRUE before the war, it still is a true picture of one of the blessings of the coming peace.

White rubber goods have practically disappeared, which indicates an extraordinary demand for them when the barrier is raised.

TITANOX will be ready with ample stocks of pigments and more and better technical information.

Meanwhile it is worth remembering that just as TITANOX pigments have the greatest whitening effect on natural rubber, so also do they have on GRS and reclaim.

TITANIUM PIGMENT CORPORATION
SOLE SALES AGENT
111 Broadway, New York 6, New York · 104 South Michigan Avenue, Chicago 3, Illinois
350 Townsend Street, San Francisco 7, California
2472 Enterprise Street, Los Angeles 21, California



Serving Dependably—
Speeding Production

★

★ **ADVAN** . . . New delayed action accelerator recommended for GRS for footwear, hose covers, CV insulation, etc.

★ **ADVAGUM** . . . Synthetic thermoplastic used to assist processing of Buna N type synthetics.

★ **ADVAWET** . . . Series of powerful wetting out and emulsifying agents. Also suitable for stabilizing synthetic latices and dispersions.

★ **COPPER NAPHTHENATE** . . . Powerful mildewproofing agent. Meets all Armed Forces specifications.

★ **EXTENDER 15** . . . Extender for dibutyl phthalate and other plasticizers. Readily available.

★ **OROPLAST** . . . Sulfur reactive plasticizer for GRS.

★ **PLASTOFLEX** . . . Series of efficient plasticizer for vinyl chloride resins. Good low temperature flexibility.

★ **PLASTOFLEX 10** . . . Replacement for dibutyl phthalate in Buna N type synthetics. Gives high resilience.

★ **PLASTICIZERS VA** . . . Plasticizer for vinyl acetate polymers as replacements for latex and for shoe adhesives.

★ **PLASTAC** . . . Tackifier and plasticizer for GRS.

★ **RESIN V** . . . Tackifier for GRS, also in adhesive work with GRS latices.

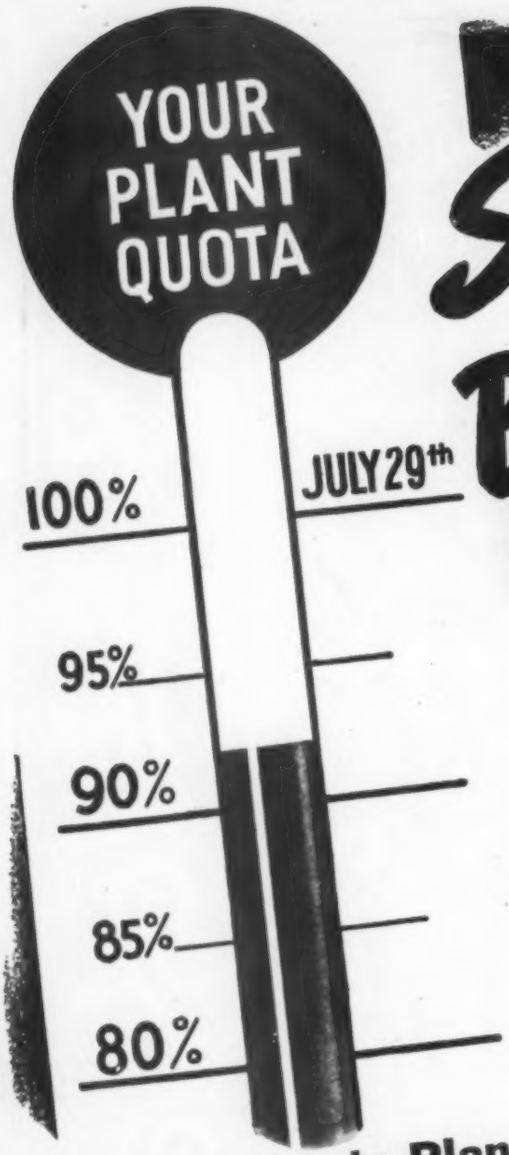
★ **VISTAC** . . . Series of hydrocarbon polymers being used as tackifiers and processing aids for GRS, Vistanex Polybutene and other rubbers.

★ **ZINC NAPHTHENATE** . . . Colorless mildewproofing agent for fabrics such as duck, braid, etc. Meets government specifications.

★

ADVANCE SOLVENTS & CHEMICAL CORPORATION

245 Fifth Avenue — New York 16, N. Y.



Stay at Your Battle Stations!

MANAGEMENT • LABOR

—the 5th War Loan Drive is still on.

July 29th is the last pay day in the Drive.

The U. S. Treasury has set the overall goal at $16,000,000,000 —$6,000,000,000 from individuals alone. This is the biggest sum ever asked of the American people—*and it must be raised!*

Keep fighting. The 5th War Loan is a crucial home front battle of tremendous importance to the total war effort.

Tighten up your 5th War Loan Drive organization. Step up your solicitation tempo. Drive! Drive!! Drive!!! Hit your Plant Quota's 100% mark with a bang that'll proclaim to all the world that the U. S. Home Front is solidly in back of the Fighting Front.

Need help? Need ideas? Call on the Chairman of your War Finance Committee. He's standing by.

Here's the Quota Plan:

1. Plant quotas are to be established on the basis of an *average* $100 *cash* (not maturity value) purchase per employee.
2. Regular Payroll Savings deductions made during the drive accounting period will be credited toward the plant quota.
3. Employees are expected to contribute toward raising the cash quota by buying extra 5th War Loan Bonds: 1—Outright by cash. 2—By extra installment deductions. 3—By extra installment deductions plus cash.

Example: JOHN DOE MFG. CO.—1,000 Employees

1,000 Employees x $100 Regular payroll deductions during the eight weekly payroll accounting periods of June and July. . . $100,000 Cash Quota

30,000

$70,000 (to be raised by sales of extra Bonds).

BACK THE ATTACK—SELL MORE THAN BEFORE

The Treasury Department acknowledges with appreciation the publication of this message by

THE RUBBER AGE

★ ★ *This is an official U. S. Treasury advertisement—prepared under the auspices of Treasury Department and War Advertising Council.* ★ ★

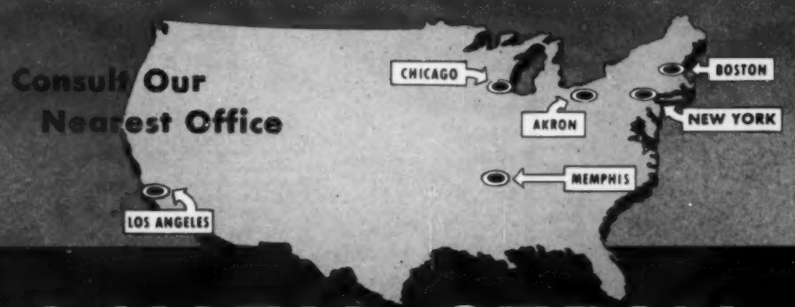
Backed by an experience of nearly 40 years, it is only natural that our nation-wide organization should have the "know-how" to assist you in all matters relating to

Rubber

SYNTHETIC CRUDE SCRAP

ALSO HARD RUBBER DUST • BALATA

LET US SERVICE YOUR RUBBER RESERVE PERMITS



H. MUEHLSTEIN & Co. INC.

122 EAST 42nd STREET, NEW YORK 17, N. Y.

CHICAGO: 327 So. La Salle St. • AKRON: 250 Jewett St. • LOS ANGELES: 1431 E. 16 St. • MEMPHIS: 46 W. Virginia Ave. • BOSTON: 31 St. James Ave.

The Obligation of a Name

Adherence to long established, sound principles, in dealing with its customers has built a desirable, nation-wide reputation for the St. Joseph Lead Company. Its years of experience in the production of lead-free zinc oxides of consistent high quality has resulted in a spirit of responsibility among the members of this organization. This assumes tangible form in the manner by which a great tradition continues to be transformed into quality products.

ST. JOSEPH LEAD COMPANY

250 PARK AVE., NEW YORK, 17, N. Y.

MADE BY THE LARGEST PRODUCER OF LEAD IN THE UNITED STATES

In Full Scale Production At *Continentals'* New Furnace Black Plant...

Continex SRF

SEMI-REINFORCING FURNACE BLACK

Production of Continental's new line of quality furnace blacks is now under way at full plant capacity after many months of product development and plant construction. Designed specifically for rigidly-controlled production, Continental's new plant at Sunray, Texas, for the present will concentrate on production of a semi-reinforcing black, CONTINEX SRF, which delivers exceptional strength and loading capacity plus higher rebound resilience and long service life.

CONTINENTAL CARBON COMPANY

MANUFACTURER

[CONTINENTAL CHANNEL AND FURNACE BLACKS]

WITCO CHEMICAL COMPANY

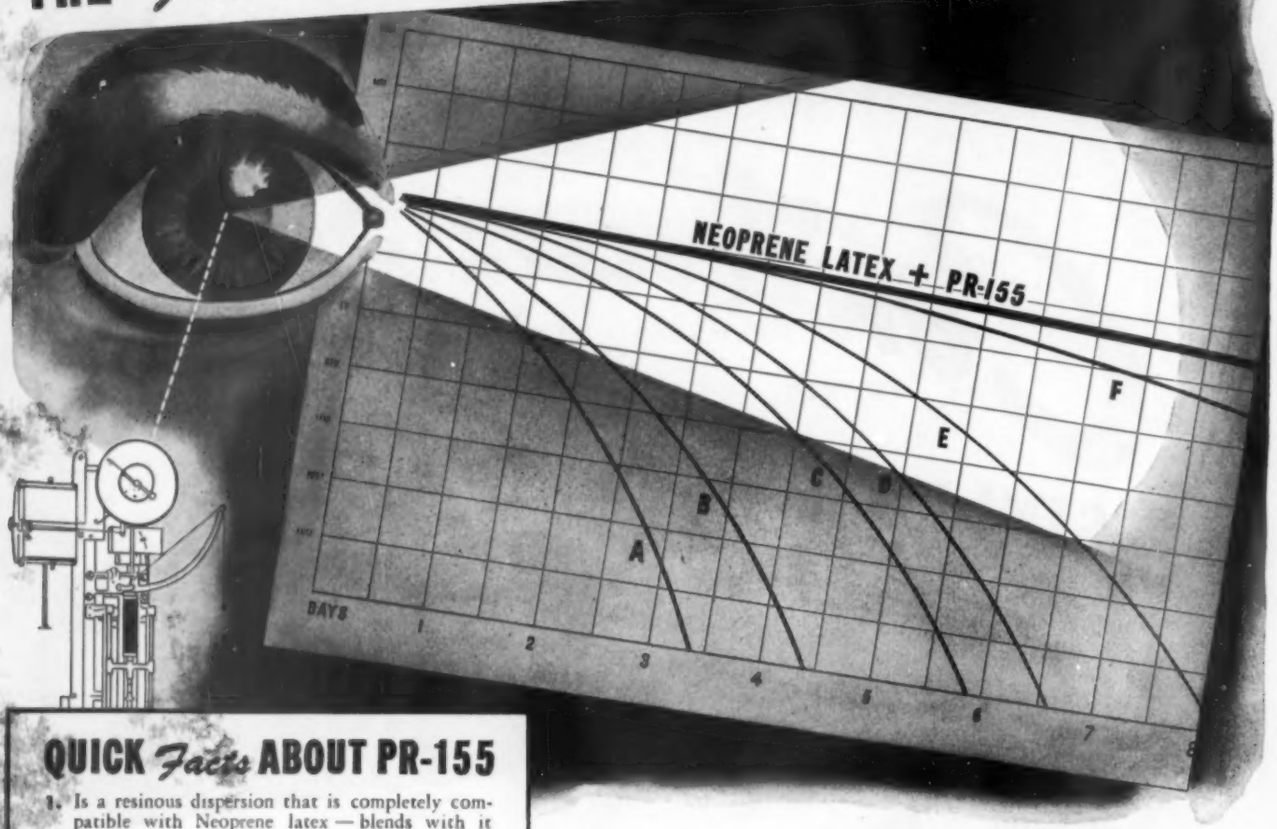
DISTRIBUTOR

[FORMERLY WISHNICK-TUMPEER, INC.]

MANUFACTURERS AND EXPORTERS

295 MADISON AVENUE, NEW YORK 17, N. Y. · Boston · Chicago · Cleveland · Akron · Detroit · London

THE *Facts* ABOUT COMPOUNDING NEOPRENE LATEX



QUICK *Facts* ABOUT PR-155

1. Is a resinous dispersion that is completely compatible with Neoprene latex — blends with it intimately.
2. Produces Neoprene latex adhesives suitable for almost all former natural latex uses and possessing all the added advantages of oil resistance, etc. characteristic of Neoprene.
3. **Provides Neoprene latex adhesives which have pressure-sensitivity (dry tack) from a few hours up to 4 or 5 days, as desired.**
4. Contains necessary anti-oxidants and protective agents to insure proper ageing of the compounded adhesives.
5. Enables extension of Neoprene latex at substantial over-all savings. (Due to the unusually high strength of Neoprene, greater extension is possible in proportion to true rubber-like characteristics desired.)
6. Can be compounded with Neoprene latex in your own equipment, or UBS will compound and ship the desired finished adhesive to you.

Field Tests show UBS formulation PR-155 to be a most satisfactory Neoprene Latex Compound Base . . .

As the above graph illustrates, many dispersions, when compounded with Neoprene Latex, show definitely unsatisfactory ageing qualities. That's why users are so pleased with the bonding strength and lack of deterioration actual field tests show that PR-155 provides. The result of many years of practical experience compounding Neoprene, PR-155 is an original development of the UBS Laboratories. Write today for further information. Address your inquiries to the Union Bay State Chemical Company, Rubber Chemicals Division, 50 Harvard Street, Cambridge 42, Massachusetts.

For masking the basic odor of Neoprene Latex, we suggest using UBS Masking Perfume — Formula D6.

UBS

UNION BAY STATE
Chemical Company

Serving Industry with Creative Chemistry

ORGANIC CHEMICALS · SYNTHETIC LATEX · SYNTHETIC RUBBER
PLASTICS · INDUSTRIAL ADHESIVES · DISPERSIONS
COATING COMPOUNDS · IMPREGNATING MATERIALS · COMBINING CEMENTS

Latest Information on
REINFORCING GR-S with ZINC OXIDE

COMPOUND

GR-S	100.0	E.L.C. Magnesia	5.0
Sulphur	4.0	Cumar MH 2½	7.5
Mercaptobenzothiazole	1.5	Zinc Oxide	100.0

In obtaining satisfactory physical properties with Zinc Oxide in GR-S, the experience accumulated in compounding reinforcing amounts of Zinc Oxide in natural rubber is not always applicable. The reinforcing properties of Zinc Oxide in GR-S are influenced to a much greater degree by the proper balance of accelerators, softeners and sulfur than in natural rubber compounds. These properties are also influenced by the presence of organic fatty acids in GR-S, which prevent the dispersion of Zinc Oxide.

The low physical results obtained with conventional treatment (500 psi) probably are due to the failure to procure satisfactory dispersions, indicating the need for special mixing or for special compounding. Early in the work with GR-S it was found that litharge accelerated compounds gave quite satisfactory results. This is now believed to be due to the preferential reaction of litharge with the fatty acids present in GR-S to form soaps, which in turn act as dispersing agents for Zinc Oxide.

Extra light calcined magnesia functions in a manner similar to litharge to form soaps. The coumarone-indene resins are also effective as dispersing agents in GR-S compounds. Working on this theory, special compounds of reinforcing amounts of Zinc Oxide in GR-S with small amounts of extra light calcined magnesia and coumarone-indene resins were prepared, by special mixing, giving the following preliminary results:

TABLE I—Accelerator With MgO, Cumar, and High Sulfur Loadings

Time of Cure Min. at 45 Lb.	Ten. Str. Lb./Sq. In.	Per Cent Elongation	Load (Lb./Sq. In.) For Elongation of:				Permanent Set
			200%	300%	400%	500%	
7.5	980	935	120	165	245	325	.35
15	1210	800	165	250	330	445	.29
30	1250	650	210	290	455	625	.26
45	1080	590	210	330	455	705	.22
60	1020	560	245	365	490	775	.21
90	1040	530	250	375	580	875	.19

As indicated by the stress-strain and rebound data, the above is a slow-curing compound. Where faster cure is desired, it can be accomplished by the usual adjustments in accelerator and sulfur.

Time of Cure Min. at 45 lb	Shore Hardness	Pendulum Indentation in mm.	Per Cent Rebound	Compression Fatigue (Goodrich Flexometer)*					Cut-Growth Resistance Inches Failure at	
				Per Cent Initial Comp.	Running Time and Per Cent Permanent Set	Max. Temp. Rise °C.	Dynamic Compression		9000 Cyc.	20000 Cyc.
							Initial	Final		
60	47	7.94	55.1	24.7	15′-6.9	20.3	16.5	20.8	.15	.29
90	50	7.83	54.5	23.8	15′-3.4	19.9	15.3	17.9		

*Test Conditions: 100 Lb. Load. 0.15″ Stroke. 100°C Oven Temp.

Work on reinforcing amounts of Zinc Oxide in GR-S is being continued and we shall keep you up-to-date on all new developments.

TABLE II—24-Hour Geer Oven Agings at 100°C

Time of Cure Min. at 45 Lb.	Ten. Str. Lb./Sq. In.	Per Cent Elongation	Load (Lb./Sq. In.) For Elongation of:					Permanent Set
			100%	200%	300%	400%	500%	
7.5	990	540	165	250	370	575	865	.14
15	720	425	170	300	425	635	...	.11
30	1020	470	170	340	465	720	...	.15
45	940	430	170	345	515	815	...	.14
60	1190	480	210	340	510	805	...	.18
90	1150	480	210	340	465	765	...	.19

The aging results are specially noteworthy in that the elongation is maintained and the modulus does not increase unduly.

New Jersey Zinc

THE NEW JERSEY ZINC COMPANY • 160 FRONT STREET, NEW YORK 7, N. Y.

MILLIONS OF FEET TREAD SAFELY ON

HEELS AND SOLES USING RECLAIMED RUBBER

In yet another way reclaimed rubber is taking the place of a scarce material, — leather for heels and soles of army shoes. The substitution has been so successful that these now outwear the best leather under service conditions.

PEQUANOC RECLAIMS

are especially suitable for this because they are dependable and uniform in quality.

PEQUANOC RUBBER CO.

QUALITY RECLAIMS FOR SPECIFIC PURPOSES

BUTLER NEW JERSEY

SALES REPRESENTATIVES

Harold P. Fuller
31 St James Avenue
Boston, Mass.

Burnett & Co. (London) Ltd.
189 Regent Street
London W. 1, England

There's Going to Be a THUNDERSTORM!

Ohmigosh! We hate to look . . .

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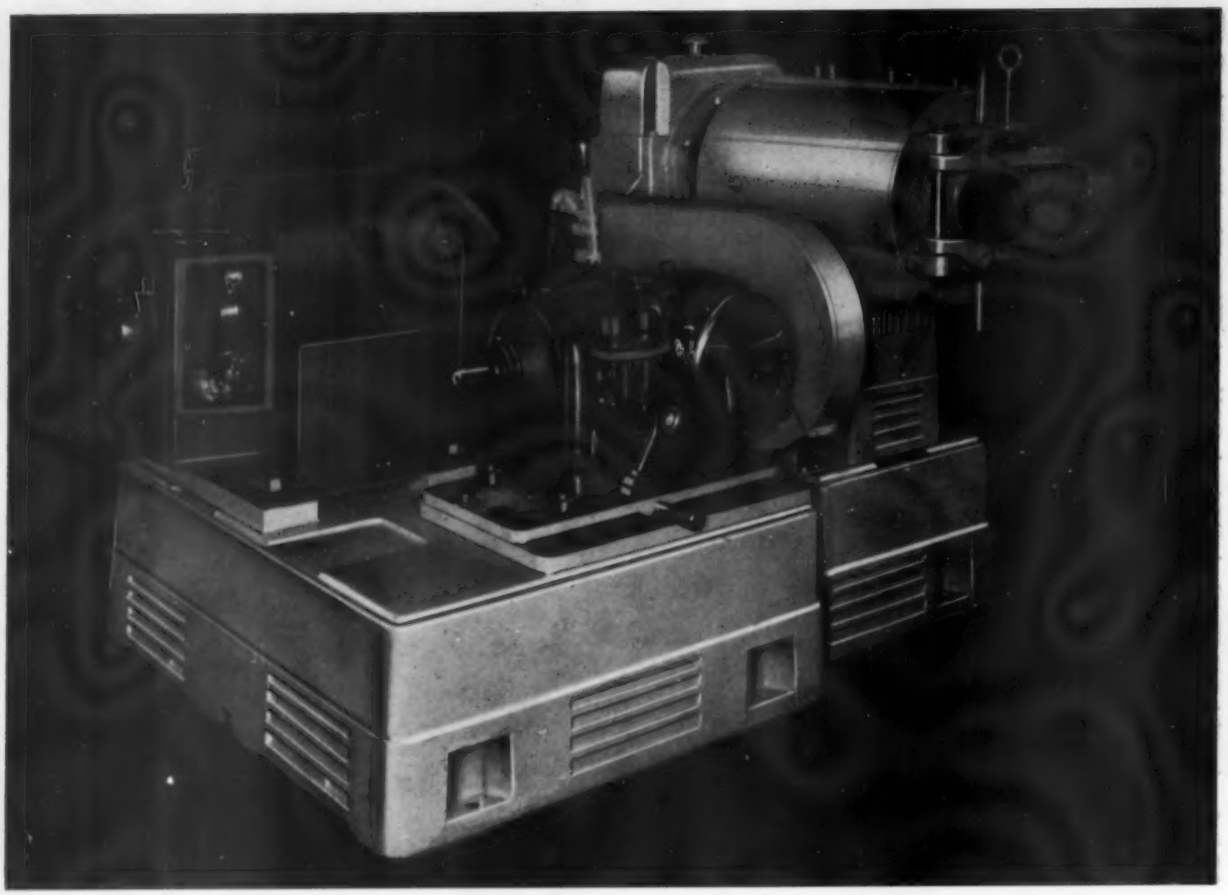

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The **RUBBER AGE**

VOL. 55, No. 4 **JULY, 1944**

Derivatives of Synthetic Rubber

By HERBERT A. ENDRES

Assistant Director of Research,
Goodyear Tire & Rubber Co., Akron, Ohio

FOR more than a century the chemistry of the rubber hydrocarbon has attracted the attention of chemists from both a theoretical and practical standpoint. During this time a large number of rubber derivatives other than reaction products with sulfur have been studied. To the early chemist these derivatives were of interest primarily as a means of obtaining further information concerning the structure of the rubber molecule. The abundant supply and low price of natural rubber during the late twenties greatly stimulated interest in its use as a chemical raw material and resulted in the commercial development of a number of these derivatives.

By processes of cyclization, chlorination, and hydrochlorination, natural rubber was converted into products with great hardness and rigidity, and increased resistance to moisture and corrosive influences. These products found many uses in protective coatings of the paint and lacquer type, in wire insulation compositions, as films for packaging foods and other products, as paper coatings to reduce moisture penetration, as adhesives and in a number of other applications. A resume of the technological development and uses of these derivatives and of their synthetic facsimiles is presented below.

Cyclized Rubber

As early as 1910 Harries *(1)* recorded the preparation of an isomer of the cycle type by treating Para rubber at ordinary temperatures with concentrated sulfuric acid. The product was an amorphous powder, insoluble in the usual rubber solvents and appreciably more saturated than ordinary Para rubber. Ostromislensky *(2)* in 1915 and Kirchhof *(3)* in 1920 also investigated the reaction products with sulfuric acid. But it was not until 1927 that Fisher's investigations led to the production of commercially useful thermoplastics from a rubber derivative.

The purpose of Fisher's research was to convert rubber into the thermoplastic products with properties similar to gutta-percha, balata and shellac *(4)*. He accomplished this by heating in sheet form a mixture of rubber with approximately 10% its weight of either an organic sulfonyl chloride or an organic sulfonic acid. A mixture of 7.5 parts of *p*-phenolsulfonic acid and 100 parts of rubber gives a flexible gutta-like, benzene soluble product, having the properties shown in Table I.

This is a very good rubber-to-metal adhesive and has been used extensively for this purpose. These sulfuric acid type conversion products can be vulcanized to non-thermoplastic materials by heating with sulfur and since they are chemically less unsaturated than rubber they do not require as much sulfur.

Another type of cyclized rubber is formed by the reaction of halogenated acids of tin, such as chlorostannic acid ($H_2SnCl_6.6H_2O$) or chlorostannous acid ($H_2SnCl_3.3H_2O$), on rubber *(5)*. The reaction may be accomplished by direct addition of approximately 10% of the reagent to rubber on a mill or to a solution of rubber in benzene *(6)*. The products contain a certain proportion of bound chlorine, depending upon the temperature of the reaction and other conditions. In carry-

TABLE I—PROPERTIES OF CYCLIZED RUBBER

(p-Phenolsulfonic Acid Reaction Product)

Specific Gravity	0.980
Tensile strength	2600 lbs. per sq. in.
Elongation at break	27%
Impact strength	50 lbs. per sq. in.
Dielectric strength	47,500 volts per mm.

Note: This article was presented at the Rubber Session of the 1944 Canadian Chemical Conference, held in Toronto, Ontario, Canada, on June 6, 1944.

ing out the solution process, which is the preferred procedure, a 10% solution of rubber in benzene is heated with chlorostannic acid in a jacketed reactor equipped with a reflux condenser. An enormous reduction in the viscosity of the solution takes place during the heating and the rubber is converted into a thermoplastic resin.

The physical properties of the product are determined by the time of reaction and a series of resins can be obtained having distortion points varying from 25° to 110° C. The resin is recovered from the solvent as a finely divided powder and vacuum dried. The solubility of this product can be increased and its solution viscosity reduced by milling between rolls. The milled material is soluble in aliphatic, aromatic, chlorinated and terpene hydrocarbons, and films deposited from these solutions are colorless, transparent, glossy, non-tacky and heat sealing.

The cyclized rubber derivatives made by this process can be made to vary from balata-like substances to exceedingly hard materials resembling ebonite, depending on the time of reaction. They are amber colored thermoplastics which are definitely more saturated than rubber, having a polycyclic ring structure. The material having a softening point of 80° to 100° C. has the optimum mechanical properties and the figures in Table II are presented to illustrate its dissimilarity to unvulcanized rubber which has practically the same rubber hydrocarbon content.

These cyclized derivatives possess remarkable resistance to acids, alkalis and other corrosive influences and have, therefore, found application in paints to resist these conditions. For this purpose a derivative having a softening point of 55° to 65° C. is preferred. This material is an excellent medium for dispersing pigments by plastic mixing, which is much more effective than the conventional wet grinding methods employed in the paint industry. Electron microscope studies of carbon blacks treated in this manner show very good dispersion of the pigment (see accompanying illustration). When such mixtures of cyclized rubber derivative and pigments are mixed with a solvent the derivative dissolves, releasing the pigments in a dispersed condition suitable for use in the formulation of protective coatings. Such coatings dry rapidly and then gradually oxidize to form hard films. The cyclized rubber will take up about 8% of oxygen and the oxidized film becomes insoluble in aliphatic hydrocarbons, but is still swollen, although not dissolved, by aromatic hydrocarbons. This hardening or oxidation process is accelerated by exposure to light, by baking, or by the use of paint driers.

As the 55° to 65° C. softening point derivative can be handled in various solvents at fairly high concentration and dries to a transparent, colorless, glossy, non-tacky film which is highly resistant to water and moisture vapor penetration, it has been used quite extensively as a coating for making paper both moisture and vapor-proof. Where transparency is not a factor and some gloss and heat seal strength can be sacrificed, mixtures of this material with various waxes have been used, either as hot dips or coating solutions. Another use is as a stiffening agent for rubber in wire insulation compounds which must be extruded to proper gauge with accurate centering and must have good physical, electrical, and water resisting characteristics.

A cyclization product with somewhat lower softening point has been used as a rubber-to-metal adhesive. Through its application and subsequent vulcanization, rubber is welded to metal with integral adhesion. A wide range of compounds may be bonded to steel, aluminum, zinc, lead, tin and wood in this manner.

TABLE II—PROPERTIES OF CYCLIZED RUBBER

(Chlorostannic Acid Reaction Product)

Rubber hydrocarbon content	92% minimum
Specific Gravity	1.06
Softening point	80°-100° C.
Cold flow (2000 lbs. per sq. in., 120° F., 24 hrs.)	0.00035 in./in.
Molding temperature	125°-155° C.
Tensile strength	4000-5000 lbs./sq. in.
Compressive strength	8500-11000 lbs./sq. in.
Flexural strength	7000-9000 lbs./sq. in.
Water absorption (24 hrs. immersion)	0.03%

Chlorinated Rubber

Another quite widely used rubber derivative is chlorinated rubber. One of the earliest records of the production of chlorinated rubber seems to be that of Engelhard and Day in 1859 *(7)*. They described the products which they obtained as ranging from a flexible limp material like leather to a white hard mass of the consistency of vulcanite. Since that time numerous other investigations have been carried out both of a practical and theoretical nature.

A chlorinated rubber introduced by Peachey *(8)* more than 25 years ago, was the first derivative of this type to be used commercially. It was obtained by the exhaustive chlorination of natural rubber and was characterized by its stability towards alkalies, acids, nitrous fumes and corrosive agents. It was described as a grayish-white amorphous powder that could be masticated, calendered like rubber, or molded, with or without the addition of filling material, into any desired shape, by the combined action of gentle heat and pressure.

A possible explanation of the mechanism of the chlorination of rubber has been proposed by Kirchhof *(9)*, according to which chlorine first adds on at the double bonds and after these have become saturated HCl is split off leaving the product unsaturated. This is followed by addition of chlorine at the double bonds to form trichloro and tetrachloro derivatives, which contain 61.4% and 68.5% chlorine, respectively. The commercial products contain 65% to 68% chlorine and thus correspond to mixtures of the trichloro and the tetrachloro derivatives.

Rubber chloride is a light yellow-to-white odorless solid of specific gravity 1.5. It is unattacked by strong acids and alkalies and although it is chemically inert it is readily soluble in aromatic hydrocarbons and is compatible with a large number of plasticizers and natural gums. Paints can be prepared from these solutions by the conventional wet grinding procedures. The outstanding characteristic of such paints is their resistance to corrosive influences. Because of its high adhesion when properly compounded, rubber chloride may be used as an adhesive for wood, leather, paper, cork and cloth.

Hydrochlorinated Rubber

As early as 1900, Weber *(10)* prepared rubber hydrochloride by passing hydrogen chloride through a solution of rubber in chloroform and precipitating the reaction product with alcohol. Weber and subsequent workers used the results of their investigation chiefly as a means for studying the chemical composition of rubber.

The addition of hydrogen chloride to rubber has been carried out commercially by three different processes. According to the first method, rubber in the form of small cubes is heated with liquid hydrogen chloride under pressure. The second method comprises passing gaseous hydrogen chloride into a solution of milled rubber until the theoretical quantity has been absorbed; then the mixture is allowed to ripen for a period and the excess hydrogen chloride is neutralized. In the third method thin sheets of milled rubber are suspended in gaseous hydrogen chloride until the desired quantity has been reacted.

The commercial grades of rubber hydrochloride made by the first method are thermoplastic, tough products which have good electrical properties and ozone resistance and are available in the form of hard massed sheets. These products may be vulcanized with sulfur and accelerators to give rubber-like products which are no longer thermoplastic. The principal applications of these hydrochlorides are in paper coatings, protective coatings, electrical and other molded products, adhesives and printing inks.

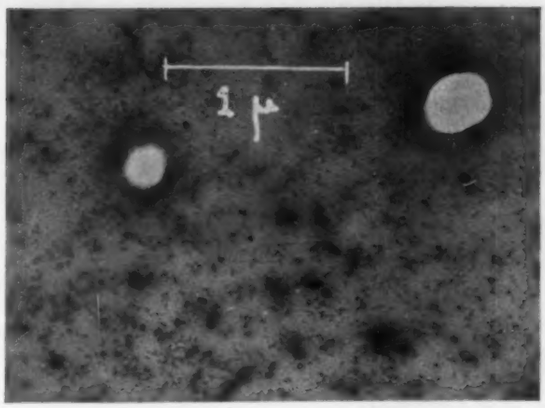
The rubber hydrochloride prepared according to the second method is used chiefly in the manufacture of transparent films for packaging foods and other products. By reacting rubber $(C_5H_8)_n$ with hydrogen chloride a product containing about 34% chlorine is theoretically obtainable having the formula $(C_5H_9Cl)_n$. The desired characteristics are obtained, however, by limiting the chlorine content to 28 to 30%. Compounds which contain a greater chlorine content are brittle, while those with less chlorine are tacky. Coloring materials and an organic protective agent to prevent deterioration from the sun are added to the solution. The solution is then spread as a film on a moving belt, is dried, and then is continuously removed from the belt.

Actual packaging applications of rubber hydrochloride were begun in 1936. Since then there has been a rapidly increasing use of this material as a protective wrapper in the food industries for the packaging of cheese, meat, frozen and dehydrated foods, coffee, and other products. The unique properties of this rubber hydrochloride which make it particularly suitable for these applications are *(11)*:

1. Low moisture vapor transmission.
2. Heat sealing qualities.
3. Oil, grease and solvent resistance.
4. Low temperature flexibility.
5. Non-blocking at high temperatures.
6. High tear strength.
7. High shock resistance.
8. Gas diffusion characteristics.

The relatively poor sunlight resistance of this material is not of importance in these applications.

The physical properties of rubber hydrochloride may be fundamentally changed by a tensilizing treatment *(12)*. In this process the rubber hydrochloride sheet material is heated to 180 to 230° F. to make it plastic.



Electron micrograph showing carbon black in cyclized synthetic rubber (25,000 X)

While in the plastic state the material is stretched from three to six times its original length and then cooled in the stretched condition. As compared with untreated material of the same gage, the tensilized material has much greater tear resistance at right angles to the direction of stretch, and has greater tensile strength in the direction in which it was stretched.

Synthetic Rubber Derivatives

In many instances the derivatives of natural rubber described above met a need which was not fulfilled by any other available materials and their commercial use was, therefore, firmly established when our supply of natural rubber was cut off by the war. Whether all of these needs can be met with derivatives of synthetic rubber is a subject for a considerable amount of research. Several such derivatives have been prepared and their properties studied, and the results obtained thus far indicate that many of the desirable features possessed by the derivatives of natural rubber can be duplicated in the synthetic products.

Due to the status of world affairs research on synthetic rubber derivatives has not advanced rapidly. However, some investigations have been carried out in the field of chlorinated and cyclized derivatives which are of considerable interest.

Chlorinated Synthetic Rubbers

Several patents have been issued covering the preparation of chlorinated butadiene rubbers *(13)*. In one of these the inventor claims that derivatives with desirable lacquer producing properties are obtained by effecting the chlorination at a temperature above 60° C. The chlorination products which are obtained are said to have a higher chlorine content and a higher softening point than those prepared at a lower temperature. These products are also claimed to be compatible with drying oils such as linseed oil whereas the products which are obtainable by chlorination at lower temperature are insoluble in such oils.

In order to obtain a chlorinated synthetic rubber of a sufficiently low viscosity for the lacquer industry, another process describes subjecting the butadiene polymer to an oxidizing treatment at a temperature of 80°

TABLE III—PROPERTIES OF CHLORINATED GR-S

Chlorine content	53%
Viscosity (20% solution in toluene)	0.50-20.0 poises
Solubility	Aromatic hydrocarbons, chlorinated hydrocarbons, ketones, esters of organic acids
Compatibility (5% or more)	Paraffin, chlorinated paraffins, tricresyl phosphate, dibutyl phthalate, isobutyl linoleate
Stability	Equal to chlorinated natural rubber
Softening point	75°-85° C.
Moisture vapor transmission on glassine:	
Coating weight Lbs./ream	M.V.T. grams/sq.m./24 hrs.
3.3	114.7
5.6	70.4
10.5	49.9
Flexibility	Greater than chlorinated natural rubber
Specific Gravity	1.36-1.39
Adhesion	Equal to chlorinated natural rubber
Tensile strength	5100 lb./sq. in.
Elongation	18.7%

to 140° C. in the presence of antioxidants. After chlorination it is stabilized by incorporation of ethylene oxide derivatives. The chlorination product thus obtained has a relative viscosity of 10 in a 5% solution in chloroform.

Another investigator *(14)* has found that the viscosity of synthetic rubber chloride depends on the conditions of chlorination, separation, drying and stabilization. The higher the degree of chlorination, the more stable and resistant is the product. The most effective solvents are benzene and chlorohydrocarbons, followed by esters and some ketones. Mixtures of solvents may, under some conditions, be more effective than pure solvents. The most viscous solutions are those in carbon tetrachloride. This investigator found that synthetic rubber chloride is miscible with oils, and resins, but not with crude rubber, celllulose esters, phenol-formaldehyde resins, wax and paraffins. The greater the molecular weight the better it forms films; the strength of the films depends on the chlorine content. The alkali resistance makes it suitable for use in paints for concrete. However, because this synthetic rubber chloride absorbs light strongly, it is unsuitable as an outside lacquer. Furthermore, the elasticity and toughness of the films are greatly affected by temperature.

In Russia *(15)* synthetic rubber and rubber produced from native plants like kok-saghyz, Valochnik, and guayule, have been used as the bases for chlorinated rubber. Initial tests were made with rubber in a dry state as well as in solution but all attempts at chlorinating dry rubbers ended in failure. Dichloroethane was found to be the best solvent for the chlorination. Chlorination of the natural rubbers was accelerated by iodine, antimony chloride, and aluminum chloride. Chlorination in the presence of iodine increased the stability of chlorinated rubbers; aluminum chloride and antimony chloride increased the percentage of fixed chlorine. The resins in resinous rubbers for the most part chlorinate and eventually act as plasticizers.

Chlorination of synthetic rubbers in solutions containing iron reduced the stability and solubility of the product. Lead decreased the solubility but not the stability of the product. Both iron and lead had no effect on the amount of chlorine which combined.

As far as chlorine content and outward appearance are concerned, the closest resemblance to chlorinated plantation rubber was shown by kok-saghyz (55% Cl), Sovprene (59.5% Cl), and beresklet gutta-percha (58% Cl). Then came eukomia gutta-percha (54.7% Cl) and S.K.B. (52%). Chlorinated kok-saghyz and S.K.B. showed the highest viscosity so that it was possible to prepare lacquers in xylene with concentrations of only 15 to 20%. The other types of chlorinated rubber have much lower viscosity, and the concentration in xylene can be 30 to 40%.

The stability of these chlorinated rubbers was not impaired by heating for 12 hours at 60 to 80° C., nor did any softening take place when the temperature was kept at 60° C., but with prolonged heating at 80° C. chlorinated S.K.B. begins to soften.

As a result of British investigations, butadiene-acrylonitrile rubbers have also been chlorinated *(16)*. It has been shown that tough, strong, elastic products, which have an extensibility of the order of 600% over the non-chlorinated starting material, may be obtained by controlling the degree of chlorination so that only up to 3% of chlorine is contained in the polymer. The rubbery chlorinated product is sufficiently plastic to be worked on rubber rolls and may be modified by the addition of fillers. It is claimed that these modified or unmodified products may then be substituted for the ordinary polymer in oil-resistant cable sheathing, molding compounds, oil gaskets, tires, hose, or wherever a product having greater strength, toughness, or elasticity is required.

By the process of another invention *(17)* there is produced a white, thermally-resistant, thermoplastic chlorinated polyisobutylene polymer, having any desired percentage of chlorine, by chlorination under controlled temperature and pressure in the presence of discoloration preventing substances. The desired amount of the stabilizer or discoloration preventor is added to the polymer solution prior to chlorination. The preventor may take the form of amino acetic acid in the proportion of 0.05% to 5.0%; or may be acetic acid or an amine such as diamyl amine. The chlorination is carried out in a solvent such as carbon tetrachloride, hexachlorethane, etc.

The resulting polymer is highly resistant to heat and retains the clear white color of the pure chlorinated polymer in the presence of traces of iron salts which otherwise would produce a serious discoloration and easy breakdown.

The exact method of operation of the discoloration preventing substances is as yet unknown but it is believed that the chlorine combines with the traces of metals present to produce metal chlorides, which may be the cause of the breakdown and discoloration, and that the preventor or stabilizer substances function by forming some type of compound with traces of iron, aluminum and zinc salts, which compounds are either insoluble or are removed from the sphere of chlorination by some other chemical factors.

Another white, heat-stable, chlorinated polyisobutylene polymer is described *(18)* which contains small

proportions of chlorinated rubber substance. In practicing the invention the polyisobutylene and natural rubber are dissolved in a chlorine resisting solvent and then chlorinated under controlled conditions of temperature and pressure. A product containing varying percentages of chlorine may be obtained.

In the lower ranges of chlorine content the resulting material is a plastic white solid and, in the very lowest ranges, slightly sticky and stringy. The higher percentages of chlorine result in a substance which tends to be more or less friable, and even brittle. The product is described as particularly desirable for paints, lacquers, enamels and insulating materials as well as for coating compositions generally in combination with both the natural resins and the synthetic resins, and also for printing inks, leather finishes, insulating varnish, etc.

The solubility of the chlorinated product varies according to the proportion of chlorine introduced, and with the solvent, the lower proportions of chlorine giving a material which is relatively highly soluble in hydrocarbons and chlorinated hydrocarbons; higher percentages of chlorine give a material which is soluble in some oxygenated solvents, and compatible with the ordinary drying oils and also with the natural and synthetic resins.

In our own laboratory we have chlorinated a variety of synthetic elastomers and have obtained a material from GR-S synthetic rubber (75% butadiene: 25% styrene co-polymer) which compares very favorably with the chlorinated natural product, as shown by the data in Table III.

In mechanical properties this material is superior to chlorinated natural rubber, which at 67% chlorine content has a tensile strength of 3450 lb./sq. in. and 12.5% elongation. Preliminary tests on chemical resistance indicate that the synthetic product will be equal to the natural. The superior flexibility of the synthetic material should open avenues of use which were closed to chlorinated natural rubber.

Cyclized Synthetic Rubbers

Reference to cyclized synthetic rubber in the literature is practically non-existent. Rubber-like polymers and copolymers undergo cyclization with various degrees of reluctance, giving products which vary from soft and rubbery to hard and brittle products, as described below.

Cyclized GR-S (Butadiene: Styrene)—Whereas natural rubber may be cyclized by treating a boiling benzene solution with a catalyst, such as chlorostannic acid, GR-S requires the much higher temperatures obtainable in such solvents as phenol, cresol, neutral coal tar oils and naphthalene. In general, the procedure consists of heating a 10% to 15% solution of GR-S in one of the above solvents to a temperature of 160° to 180° C. and adding the proper amount of catalyst with agitation. After approximately 10 minutes the temperature begins to rise and the viscosity of the solution increases to form a gel. The temperature then decreases and the viscosity is reduced until, after about 30 minutes, the reaction mixture becomes a thin brown-colored solution from which the cyclized GR-S may be recovered by steam distillation or extraction of the solvent.

The resulting product is a brown resin which is soluble in aromatic and chlorinated hydrocarbons, but insoluble in aliphatic hydrocarbons and alcohol. If the reaction is stopped while in the gel stage the product is insoluble in the common organic solvents. The procedure is quite flexible and changes in one condition can be compensated by changes in another.

For example, an increase in the amount of catalyst employed will increase the rate of reaction and accomplish the same result at a lower temperature. The hardness and softening point of the product depends upon the time of reaction in much the same manner as in the case of natural rubber and can be varied from soft and rubbery to a hard and brittle resin having a softening point of 105° C. Analogous to the natural rubber reaction, a product of desired softening point may be obtained by stopping the reaction at the proper viscosity.

Various cyclizing agents or catalysts have been studied and chlorostannic acid, stannic chloride and boron trifluoride have been found to be effective in the solvents mentioned. None of these will bring about a reaction in boiling toluene solutions of GR-S at atmospheric presures, but insoluble gels have been obtained in sealed tubes at 160° C. Reactions in toluene may, however, be obtained using anhydrous aluminum chloride as the catalyst, yielding a hard, high softening point, insoluble resin, but this appears to be the product of a Friedel and Crafts' reaction rather than a cyclization. By heating GR-S in 10% solution in naphthalene with 15% its weight of concentrated sulfuric acid for 3½ hours at a temperature of 180° C. a hard rubbery product was obtained. Hydrogen chloride does not produce a resinous product at 180° C. as it does with natural rubber.

By following the procedure outlined above, cyclized derivatives of GR-S can be obtained having the properties indicated in Table IV.

The low moisture vapor transmission of this material suggests its use in moistureproof coatings for paper. Such coatings are clear and transparent and impart no taste or odor. The material also shows promise as an ingredient in moisture, alkali, and acid resisting paints and lacquers and as a reinforcing agent in GR-S wire coating compounds.

Other Cyclized Elastomers—The relatively dark color of cyclized GR-S and its insolubility in cheap petroleum hydrocarbons has encouraged work on other

TABLE IV—PROPERTIES OF CYCLIZED GR-S

Specific gravity	0.99-1.03
Softening point	55°-105° C.
Solubility	Aromatic hydrocarbons, chlorinated hydrocarbons
Iodine number	
Original GR-S	350
Soft cyclo GR-S	200
Hard cyclo GR-S	180 -60
Compatibility	Paraffin, GR-S

Moisture vapor transmission on glassine (compounded with 10% paraffin):

Coating weight Lbs./ream	M.V.T. grams/sq.m./24 hrs.
0.7	4.08
2.4	1.79
3.5	1.09

elastomers such as polychloroprene, butadiene: acrylonitrile, butadiene: ethyl chloromaleate, isoprene: styrene, polyisoprene and others.

The nitrile rubbers are very reluctant to undergo reaction, requiring as much as 50% of stannic chloride to produce a hard resin, while no cyclization could be obtained with polychloroprene. The other rubbers behaved very much like GR-S and by employing a suitable blend it was found possible to obtain a cyclization product which was much lighter in color than cyclized GR-S and readily soluble in cheap petroleum hydrocarbons. This material compares favorably with the best quality cyclized natural rubber in all properties excepting mechanical strength, which is not of importance in most applications. Its low solution viscosity and rapid drying rate make it particularly well suited for applications involving the use of volatile solvents. In Table V a comparison is made with a low viscosity cyclized natural rubber.

This cyclized synthetic rubber is finding application in many uses of importance to the war effort and is rapidly replacing the cyclized natural product.

Summary

By processes of cyclization and chlorination, synthetic elastomers can be converted into derivatives which differ from the parent product in the following respects:

1. Higher specific gravity.
2. Higher softening point.
3. Greater hardness and rigidity.
4. Less flexibility and elongation.
5. Greater chemical resistance.
6. Lower solution viscosity.
7. Lower moisture vapor transfer.
8. Lower moisture absorption.
9. Less tackiness.
10. Greater solubility in polar solvents.

Thus, many of the desirable features of the commercially important derivatives of natural rubber can be duplicated in the synthetic products. It is furthermore logical to assume that the field of usefulness of the synthetic derivatives will be extended by selection of the proper type of synthetic rubber for cyclization, chlorination, and hydrochlorination to bring out certain desirable characteristics which were not inherent in the products made from natural rubber.

TABLE V—COMPARISON OF A CYCLIZED SYNTHETIC RUBBER AND CYCLIZED NATURAL RUBBER IN SOLUTION VISCOSITY AND DRYING RATE

	Synthetic	*Natural*
Softening Point	88° C.	80° C.
Viscosity of 20% solution (Secs. No. 4 Ford cup)		
Gasoline (low boiling)	12	21
Toluene	13	23
V. M. & P. naphtha	15	52
Turpentine	30	179
Carbon tetrachloride	38	615
Drying time of 0.003 inch wet film (Secs, at 75° F. and % relative humidity)		
Gasoline (low boiling)	80	105
Toluene	140	145
Carbon tetrachloride	140	375
Turpentine	1350	2070
V. M. & P. naphtha	1620	2175

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Synthetic Rubber Tape Seals Airplane Fuselages Against Leakages

OVER two million feet per month of a newly-developed Thiokol synthetic rubber base sealing tape are today solving one of the most important problems in warplane manufacture and maintenance—sealing riveted fuselages, gasoline tanks, gun turrets and Plexiglas enclosure against leakage caused by the strain of power dives, tight rolls and other battle maneuvers.

Developed by the Presstite Engineering Company, of St. Louis, Mo., a leading peacetime manufacturer of special sealing compounds for the refrigerator industry, this Thiokol base tape is not soluble in most of the common solvents, including aromatic aviation fuel, ethyl and butyl acetate. Prolonged exposure to air does not harden the tape or change its consistency. It is, therefore, the ideal material for making fuselage seams raintight, leakproofing gasoline tanks and seaplane pontoons, as well as weather and pressure sealing cabins and turrets on high altitude bombers and fighters.

This Thiokol base sealer is not only provided in tape form in thicknesses of from .015 up to .125-inch but also in bulk form and in slugs of a size to fit the barrel of special high pressure air guns for use in resealing integral fuel tanks in existing aircraft by the pressure injection method. This method has been successfully adopted by one of the largest aircraft manufacturers to seal the leading tanks in large transport planes when there is as much as 1800 gallons of gasoline in the tank.

Molecular Structure and Rubber Elasticity

By H. MARK

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AT THE freezing point of a liquid, such as mercury, water, or toluene, a very distinct change in the mechanical properties of the material takes place within a comparatively narrow temperature range. Below this point ordinary substances are *crystalline solids;* they respond to shearing stresses by undergoing small (one per cent or less), predominantly *reversible deformations* and exhibit the long range order (100 Å or more) of a three-dimensional crystal lattice.

Each atom, ion or molecule is held (by attractive and repulsive forces of all surrounding particles) in a relatively well defined equilibrium position, about which it carries out rapid, quasiharmonic vibrations. Transition from one equilibrium position to another (self diffusion) is extremely infrequent—the average amplitude of the vibrations amounting only to about 5% of the distance between adjacent equilibrium positions. Such systems appear to us as rigid, hard substances, having a definite shape and all other characteristics of a solid body.

As one increases the temperature, the vibrations of the individual particles become more and more vigorous and—at the melting point—the forces between the constituents of the lattice cannot any more maintain the long range order of the crystal, and the whole structure breaks down. The result is a *liquid,* characterized by the absence of any far reaching geometrical order. The nearest neighbors of any individual molecule, however, are arranged about it in much the same manner as in the crystalline state, but molecules a few angstroms further away are arranged practically at random.

Each single particle, again, carries out rapid quasielastic vibrations about an equilibrium position, but this equilibrium position itself (being a minimum of potential energy) is neither fixed in its location nor in its depth and the molecule undergoes (on top of its vibrations) an irregular translational Brownian movement, which makes it change its place rather frequently (self diffusion is rapid). The lack of long range order prevents liquids from sustaining shear or stress and from assuming a definite shape; they flow. Eyring, Lennard-Jones and their co-workers have succeeded in giving a very satisfactory explanation of many important properties of liquids on the basis of this picture.

Liquids can be supercooled below their equilibrium melting point and retain the characteristics of their disordered (amorphous) geometrical structure. The viscosity increases with decreasing temperature, roughly following an exponential relationship

$$\text{viscosity} = Ae^{B/T}$$

and at sufficiently low temperatures the material becomes hard and brittle; it is called a glass. The transition from rigid glass to viscous liquid sometimes occurs in a relatively narrow temperature range (the softening point) with no sudden change in structure and with no discontinuity in the primary thermodynamic variables, such as heat content, free energy, specific volume, etc. Thus in the case of ordinary (low molecular weight) organic substances the relationship between the crystalline, glassy and liquid state can be represented by the scheme of Table I.

TABLE I—COMPARISON OF THE CRYSTALLINE, GLASSY AND LIQUID STATE

Nature of the state	*Geometrical order extends over*	*Viscosity of the material is*
Crystalline	long range	high
Glassy	short range	high
Liquid	short range	low
Rubber	Short range geometrical order plus long range entanglement.	Local viscosity is low, but viscosity of a macroscopic sample is high.

Behavior of Highpolymers

Highpolymers, in principle, exhibit a more complicated behavior. They are characterized by the existence of very large molecules, which in many cases are chains consisting of several thousand monomers, which are linked together by strong chemical bonds. The linkages *inside* the individual chains are not (or only very infrequently) severed during the normal mechanical deformation of the polymer, such as stretching of rubber or spinning of nylon, or during the various thermal treatments, such as annealing or molding. The changes in shape, which take place during these processes, occur at the expense of opened (and reclosed) bonds between the individual chains, which are not due to chemical forces, but to the various types of intermolecular interaction, such as hydrogen bridges, van der Waals forces, etc.

Let us, from this point of view, compare the crystal lattice of isoprene with that of stretched (or frozen) rubber and consider what happens if one increases the temperature of both systems.

In frozen isoprene, each individual molecule (C_5H_{10}) is located in a definite equilibrium position, about which it carries out irregular, quasiharmonic vibrations. The distance between one individual molecule and its next neighbor is about four to five AU, while the interatomic distances within the molecules are much smaller (between 1.08 and 1.54 Å). This elucidates the fact that the C_5H_{10}-molecule is held together by strong chemical bonds, having dissociation energies of 70 kg. cal. per mol. and more, while the mutual forces between the molecules are of the much weaker, van der Waals type (about 5-8 kg. cal. per mol.).

Nevertheless, at temperatures below the melting

Note: This article is an abbreviated version of a lecture on "Fundamental Aspects of Rubber Elasticity" delivered by the author before the Society of Chemical Industry in Montreal, Canada, on December 15, 1943.

point, they are sufficient to maintain the long range order of a crystal lattice and frozen isoprene is a rigid, brittle substance. Above the melting point, however, *all* long range connections between the molecules disappear and we have in front of us a liquid with rapid self diffusion of the individual molecules and low viscosity (about 10^{-2} poises).

In the crystal lattice of rubber, each individual isoprene residue (C_5H_8) and each single C and H atom within it is also vibrating about regularly spaced equilibrium positions, but a thorough investigation of their mutual distances shows that each isoprene residue is particularly close to two other residues, indicating that long linear chains of residues exist, within which all next neighbor distances correspond to strong chemical bonds. The main valence chains of isoprene extending parallel to the direction of the stress, have a length of several thousand monomers and represent the backbone of the whole structure. In all directions perpendicular to the stress the distances between adjacent molecules (in this case between the parallel chains) correspond to normal van der Waals forces. This lattice, therefore, is highly anisotropic: strong forces along the direction of stress, weak forces perpendicular to it. As one increases the temperature, the weak intermolecular bonds gradually will be broken and thus the lateral arrangement of the chains disturbed and eventually destroyed; they will start rotating about their axes, changing their mutual distances and eventually curl and coil up in an irregular way.

However, while the weak bonds *between* the individual chain molecules are severed and opened, the strong (chemical) linkages *within* them remain unaffected. The molecules are not degraded at temperatures at which the lattice structure is already destroyed. This has the important consequence that although the long range geometrical order of the lattice breaks down upon raising the temperature to the softening point, a long range entanglement due to the unaltered existence of the long chain molecules is maintained. This long range entanglement is responsible for the fact that at the softening point of a polymer, we do not get a *fluid liquid*, but a *rubbery solid*.

If we consider one individual isoprene residue in (amorphous) unstretched rubber, it will vibrate with about the same vigor as does an isoprene molecule at the same temperature in the liquid state of isoprene and it will also carry out about the same short range Brownian movement; but owing to its position in the chain molecule it will not be able to diffuse further away from its original positions without affecting other monomers or segments of the chain, of which it is a part. This geometrical restriction of the various parts or segments of the flexible linear macromolecules due to the strong bonds between them produces a long range entanglement, which enables the material to sustain moderate stresses or shears, hence to maintain a certain definite shape and resist elastically any attempt of deformation. In this sense elastomers have a state between the solid and liquid, just as glasses do, and one can briefly distinguish thus: Glasses are liquids with high viscosity; rubbers are liquids with long range entanglement (compare Table I).

The self diffusion of chain-segments is not affected by the long range entanglement and, therefore, is rapid, while any displacement of the large linear molecules *as a whole* is impeded by their mutual interaction over long ranges and therefore is very infrequent. The irregular motion of portions of the chains under the influence of the temperature has been termed by W. Kuhn "internal" or "micro" Brownian movement; the displacement of their centers of gravity, which means of the macromolecules as a whole, is referred to as "external" or "macro" Brownian movement.

Using these terms, we can briefly (and with a certain degree of oversimplification) say: elastomers are materials having fast internal, but slow external Brownian movement. It is this combination which makes a good rubber.

After having reached this conclusion, it may seem appropriate to proceed as follows: (a) Analyze briefly in some detail, how much each of these two essential characteristics contributes to the rubbery behavior of the material; (b) Discuss shortly to what extent organic synthesis of long chain molecules is capable of building up systems which combine them with each other.

Significance of The Two Different Brownian Movements

Let us first consider for which essential feature of rubberiness the two types of Brownian or molecular motion are responsible.

If we start stretching a rubber, we expect it to begin deforming at comparatively low stresses; it is supposed to be a soft, extensible material, having a low initial Young's modulus. In terms of figures, typical elastomers (soft rubbers or gum stocks) have elastic moduli between 10^6 and 10^7 dynes per sq. cm. or 15 and 150 lbs. per sq. inch. In order to extend appreciably under the influence of such small forces, the material needs a considerable degree of internal mobility, much like a normal liquid. In fact rubbers have many properties common with ordinary liquids; they possess a compressibility very similar to that of liquids, which is reflected by the fact that Poisson's modulus for all "soft" elastomers is in the neighborhood of 0.50. The coefficients of thermal expansion of rubbers are of the same order of magnitude as those of ordinary liquids and (perhaps most surprising) the solubility of gases (hydrogen, oxygen, etc.) and solids (sulfur, selenium, etc.) in rubbers resembles rather closely the solubility of the same materials in ordinary liquids.

The "local" fluidity of elastomers, produced by the fast internal Brownian motion, is also responsible for its *rapid* contraction. In a stretched elastomer certain portions or segments of the individual chains assume configurations the free energy of which is larger than in the unstretched condition. Therefore, as soon as the external force ceases to act, they will start to diffuse back into their unstrained (equilibrum) positions, which correspond to a minimum free energy and represent the relaxed state of the sample. How quickly this contraction takes place depends upon the rate of segment diffusion which determines the "local" fluidity of the material.

Certain elastomers "snap" back into the original shape, because segment motion is fast; others "creep" back, because the local mutual interaction of the chain segments is somewhat too strong and prevents them from assuming their unstrained positions within a short time. Natural rubber, neoprene, Butyl Rubber or the Buna types are examples for the first case; polystyrene above 80° C., vinylites or moist polyvinyl alcohol for the other. In order to get a good, snappy elastomer, one

has to keep the internal Brownian motion as rapid as possible, which means one has to accentuate the local liquid character of the system.

On the other hand, if we provide in an elastomer for nothing but this high local fluidity and keep a macroscopic sample of it under stress for a certain length of time, the material will flow. It will not maintain the imposed stress or shear, but, with the very aid of the rapid internal Brownian motion, will relax into the extended state instead of into the contracted. Hence, it will behave like a viscous liquid or plastic rather than like a rubber. In order to prevent this permanent loss of shape, one has to provide for long range entanglements, which make the external Brownian movement (slipping of whole chains along each other) so slow that it cannot produce any appreciable permanent set within the time the sample is in its extended state. In general, the mutual attraction of the chain by van der Waals forces does not provide for a sufficiently stable long range entanglement to conform with practical requirements. Therefore, one usually produces a system of irregularly distributed, wide spaced fix points. They provide a stable, but highly deformable network throughout the sample, which can be stretched several hundred per cent and will return into its original shape, because its individual knots are connected with each other by flexible chain molecules.

Such fix points can be produced in different ways. One is to produce strictly localized, strong chemical bonds between the individual chains, such as sulfur, oxygen, or methylene bridges, as is presumably done during the various processes of curing and vulcanizing. Another way seems to be to have groups of particularly strong molecular interaction (hydrogen bonds, strong dipoles, highly polarizable groups) or bulkiness (phenyl, benzyl, naphthyl groups) randomly distributed along the chains, thus producing an irregular network of areas with high molecular cohesion. Still another method is to distribute very small particles with high adsorption power (active fillers) in the polymer, which provide for fix points by adsorbing parts of the mobile chains irreversibly on their active surfaces.

In all these cases, the localized and infrequent strong links between the individual flexible chains suppress the macro-Brownian movement sufficiently to avoid permanent flow of the sample as a whole, while they leave the micro-Brownian movement sufficiently unaffected to allow rapid extension and contraction to be possible.

Thus an elastomer requires a compromise between small mutual interaction of the chains over short ranges and strong local interaction over long ranges; it should be a liquid of low local viscosity containing an irregular system of wide spaced, permanent fix points. Such a material will extend rapidly (because of its low local viscosity), will support the external stress without assuming a permanent set (because of the presence of the fix points), and will contract instantaneously (again because of its low local viscosity).

In whatever direction we deviate from the above prescription, we will arrive at materials with less favorable properties. If the fix point system is too dense, the range of reversible extensibility decreases, and we finally enter the domain of hard rubbers or ebonites; if the fix point system is too dilute, the ultimate tenacity of the material will be poor. If the individual fix points are not completely stable, but break down partly under the influence of the stress, the samples will exhibit a permanent set, depending upon the magnitude and duration of the deformation. If the local viscosity is too high, the material will be rigid if subjected to sudden (eventually periodic) deformations (such as in tires or shock absorbers) and will creep back from the extended state rather than snap back into the relaxed condition.

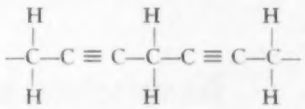
It seems, therefore, that the compromise as defined above has to be set up in a very careful and delicate way, and in order to avoid fatigue failure, has also to be maintained for a considerable period under the working conditions of the material.

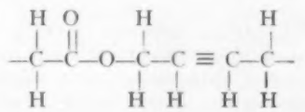
Structural Details Connected with Rubberiness

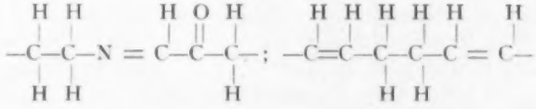
Let us now briefly consider how the structural details of a given long chain polymer, such as the nature of the chemical bonds building up the chains, the number, type and spacing of the substituents distributed along the chains, can contribute to the conditions of rubberiness, as formulated above.

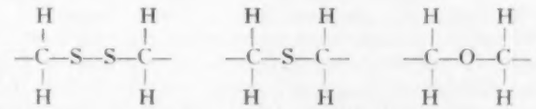
First, it seems obvious that the individual chains must exhibit a high degree of internal flexibility in order to provide for rapid micro-Brownian movement. Our present experimental knowledge indicates that the simple polyethylene chain of the type

is not the best structure to enhance rapid segment movement. First, such a chain contains too many hydrogen atoms in comparatively close packing, which interact with each other and are responsible for the strongly hindered free rotation about the individual carbon-carbon bonds in such a chain. The energy barriers, which oppose free rotation are around 3000 cal. per mol. of the bond. In order to get less hindrance due to the interaction of substituents (hydrogen, methyl, chlorine, etc.) it seems that other bond sequences in the chains should be built up. Examples for some of them are the following configurations:









A second reason why straight saturated paraffin chains are not particularly beneficial for fast segment movement is that they have a rather pronounced ten-

dency to crystallize. As soon as, in the range of higher elongations, a number of subsequent chain segments become parallelized and aligned, the forces between them, though not very large, manage to bring the smooth chains into the well ordered positions of a three-dimensional lattice and crystallites are formed under the simultaneous action of the external and the internal forces. If these crystallized areas are too stable, they will not collapse, even if the external stress is relaxed, and the material will not contract. This is, f.i., true for polyethylene or gutta-percha. In natural rubber, however, crystallites are also formed during stretching, but they disappear immediately after relaxation of the stress and the material returns into the disordered state; it melts.

Thus it seems that unhindered rotation and poor crystallizability are contributing to rapid micro-Brownian movement. The first depends, as mentioned above, largely on the sequence of linkages within the main valence chains and upon its substituents; the latter is mainly affected by the number, nature and distribution of substituents and by configurational characteristics of the chains themselves (cis-trans isomerism, ring structures, etc.). Hydrocarbons, in general, have the weakest mutual interaction and, therefore, are most favorable for rubberiness. But even here (compare polyethylene and gutta-percha) the easy fitting of certain types into a crystal lattice may and does bring about the formation of stable crystals, which give the material the properties of a plastic rather than of a rubber.

Irregular distribution of substituents, mostly as a consequence of copolymerization, is an effective means to prevent crystallization and to produce rubberiness in an interpolymer of monomers, each of which would be either a poorer elastomer or no elastomer at all. This may lead to the belief that the best effect in producing long range-quick reversible elasticity is reached by building up very irregular copolymers which, even at extreme elongations, are incapable of forming crystallized areas. This seems to be true in principle. However, if one wants to combine rubber elasticity with other mechanical properties, such as high tensile and shearing strength, it seems that the strongly reinforcing character of the crystalline phase which forms during stretching must not be neglected.

Taking natural rubber as an example, it seems fair to say that this material, if extended, manages to produce an active filler of excellent reinforcing power, namely rubber crystals. This finely divided material which is intimately merged with the disordered portions of the sample (the same main valence chains being members of both the crystalline and amorph constituents) provides for an excellent stress distr tion all over the macroscopic test piece and seems t very efficient in preventing weak spots to affect unbeneficially the mechanical performance. This becomes particularly apparent if unusual stress accumulations are deliberately set up during the experiment, such as in testing cut growth, flex cracking, notch strength, etc

Thus it seems that from the point of view of ultimate irreversible failure the existence of small, reinforcing crystalline areas is advantageous; in order not to interfere with quick reversible elasticity, however, these crystallites must not be too stable, but should disappear immediately upon relaxation of the stress.

It can be seen from the above very brief and superficial discussion, that typical rubberiness as such already depends upon the rather sharp coincidence of various conditions and—if one wants to combine elasticity with other mechanical properties, such as tenacity, fatigue, etc.—that more additional requirements have to be fulfilled simultaneously. This, apparently, is a rather difficult task. On the other hand, however, organic highpolymer chemistry offers many different ways to build up long chain molecules of widely varying characteristics. It seems, therefore, not unreasonable to expect that, as time goes on, elastomers with vastly improved properties will be synthesized, each of which—in its proper domain—surpasses natural rubber considerably in its quality.

Manufacture of Elastic Surgical Goods in Australia

ACCORDING to a report recently made to the Bureau of Foreign & Domestic Commerce of the Department of Commerce, there have been many changes in the manufacture of elastic surgical goods in Australia since the outbreak of the war. Even while restricted by government regulations as to importing supplies and making articles of which rubber is a constituent part, many companies are manufacturing articles which they formerly imported.

For example, surgical adhesive plaster is being made in Australia for the first time by two companies, and four companies are making suspensories formerly imported from the United Kingdom and the United States. There are now four companies making elastic goods, five producing elastic stockings, eight making surgical rubber goods, and seventeen making surgical belts.

While square-cut thread is produced in Australia, uncovered rubber thread in the finer counts and uncovered round extruded rubber thread are imported. Before 1939, knitted-elastic pieces were not locally manufactured. Now a company in Victoria makes its own elastic for corsetry, covers rubber thread for its own use and for sale, and produces knitted-elastic piece goods from 1 inch upward in size. Another company in Victoria produces all types of braided and woven elastics up to and including those 2 inches in width. Local manufacture can supply the bulk of the normal market's demands for elastic less than 1 inch in width.

Australian manufacturers of elastic surgical goods import most of their supplies of elastic except that used in waistbands. Because of Government control of both imports and production, the making of many articles for civilian use has been suspended and stocks of such goods are low. The question of releasing more materials for use in elastic goods for surgical purposes is said to be under consideration.

Division of High Polymer Physics, A. P. S., Holds Inaugural Meeting at Rochester, N. Y.

THE inaugural meeting of the newly-created Division of High Polymer Physics of the American Physical Society was held at the University of Rochester in Rochester, N. Y., on June 23 and 24, in connection with the 261st meeting of the parent society. A program of twenty-two excellent papers dealing with experimental and theoretical physical investigations of rubbers, textiles, plastics and high polymer materials in general was presented. A business session was held during the meeting and the by-laws of the new Division, as prepared by an organizing committee working closely with the Council of the American Physical Society, were acted upon favorably.

At the close of the meeting the Executive Committee of the Division, appointed by the Council of the parent society for the remainder of 1944, elected the following officers: *Chairman,* J. H. Dillon (Firestone Tire & Rubber Co.); *Vice-Chairman,* P. Debye (Cornell University); *Secretary,* W. James Lyons (Southern Regional Research Laboratory); *Treasurer,* L. A. Wood (Bureau of Standards). Other members of the Executive Committee include W. F. Busse (B. F. Goodrich Co.), R. Bowling Barnes (American Cyanamid Co.), and J. P. Elting (Kendall Mills).

Presentation of the technical papers was spread over four sessions, held morning and afternoon on both days of the two-day meeting. The chairmanship of the various sessions was shared by H. Mark, J. H. Dillon, W. F. Busse and M. L. Huggins. Approximately 100 members and guests were in attendance. Abstracts of all of the papers presented, together with authors and their company connections, follow herewith:

Abstracts of Papers

Theory of Filler Reinforcement, *Eugene Guth (University of Notre Dame, Notre Dame, Indiana) and Hubert M. James (Purdue University, Lafayette, Indiana).*

For small loadings (up to about 10 per cent volume parts), the colloidal carbon black spheres may be considered as suspended in a continuous rubber matrix. This "model" was first used by J. Rehner, Jr. The authors generalized this model for ellipsoidal (including plate- and rod-like) filler particles and extended it to the computation of various properties of the mixture in terms of the properties of the matrix and of the fillers. Viscosity, Young's modulus and dielectric constant of the mixture were derived as linear functions of the volume concentration for small, and as quadratic functions for higher loadings. For small loadings the tensile strength first decreases because of the stress concentrations occurring around the carbon black spheres when the samples are stretched. The increase of the tensile observed for greater loadings is due to the tendency of carbon black spheres to form chains and finally a type of network. (*cf.,* G. Goldfinger and W. R. Smith, paper at N. Y. meeting Rubber Division, A. C. S., 1944). The stiffness increases with loading, up to the concentration where the mixture becomes a dilution of carbon black by rubber. There the tensile decreases too. Binding of rubber by the black (Fielding, Wiegand) is similar to solvation. The model was checked on the rubber-calcium carbonate system and to a certain extent on the rubber-carbon black system. The theory is very similar to the theory of Einstein on the viscosity of colloidal solutions and Maxwell's work on dielectric properties.

Rise of Temperature on Fast Stretching of Butyl Rubber, *S. L. Dart and Eugene Guth (University of Notre Dame, Notre Dame, Indiana).*

In contrast to Hevea gum, Butyl gum crystallizes on stretching at much higher extensions and much more abruptly. The progress of crystallization was followed by measuring the rise in temperature on fast stretching. The rise in temperature increases first slowly with extension but shows a steep upward turn after the onset of crystallization. For 900 per cent extension a temperature rise of over 10° C. was recorded. This compares with 10-15° C. rise for Hevea gum stocks of various compositions. For Butyl tread the rise in temperature increases somewhat steeper right from the beginning due to the earlier crystallization of the tread stock. In general, more similarity exists between Butyl and Hevea tread than between the corresponding gum stocks. The cooling on retraction (after the sample was kept extended for one minute), and the residual rise in temperature after extension and immediate retraction was also observed. The initial small cooling (0.001° C.) at very low extensions was recorded by using a sensitive galvanometer. The large heat effect at crystallization was measured using a galvanometer with a period less than 0.1 sec. Based on these measurements a new method was introduced to resolve the stress into its components due to internal energy and entropy, respectively.

Retraction of Stressed Rubber, *B. Adalbert Mrowoa, S. Leonard Dart and Eugene Guth (University of Notre Dame, Notre Dame, Indiana).*

The process of the retraction of stressed rubber has been studied using several experimental methods. The most promising method employed was the use of a smoked revolving drum driven by a synchronous motor. A light stylus was fastened to the free end (or any position behind the tip) of a rubber sample; the other end of the sample was clamped. The elongation-time curves were recorded accurately and directly on the drum by the stylus. From these curves the velocity of the tip, as a function of elongation (or time), may be obtained by differentiation. For about 450% initial elongation a tip velocity higher than 220 miles/hr. was derived. The velocity of the tip is sensibly constant, except for the initial acceleration at the beginning of the retraction. This initial increase is due to the weight of the stylus and of the rubber in the grip (before the sample is released).

A two-stylus experiment (one at the tip, the other at the middle) showed clearly the lag of the middle behind the tip and hence the nature of the retraction. The middle moves only slightly slower than the tip.

For a Butyl tread stock the elongation-time curve for the tip has an exponential tail. The lag of the middle behind the tip is much smaller. The velocity of the middle point is also considerably smaller than that of the tip. The velocity of each section of the sample appears to be proportional to the distance from the fixed end.

Hevea gum and Butyl tread are the two extremes.

Hevea tread, GR-S gum and tread, and Butyl gum were found to show an intermediate behavior.

The element by element contraction of rubber was checked by high speed instantaneous photos and movies. They show clearly a well-defined wave pulse progressing along the sample. They also check the timing. The duration of the retraction is for about 100% initial elongation: 5-20 milliseconds according to the particular sample used.

Molecular Weight Studies of Some High Polymers, *P. M. Doty, B. H. Zimm and H. Mark (Polytechnic Institute of Brooklyn, Brooklyn, N. Y.).*

A number of high polymers such as proteins, cellulose, cellulose acetate, rubber, gutta-percha, polystyrene and polyvinyl chloride were investigated by various methods such as osmotic measurements (static and dynamic), viscosity determinations, ultracentrifuge runs and light scattering observations. Thus far the following results have been obtained:

(1) In the case of fractions, the molecular weights determined by the various methods checked within the limits of error of the experiments. Considering that different averages are observed by the different procedures, this may be taken as an indication that the fractions are fairly narrow.

(2) The influence of concentration on such quantities as reduced osmotic pressure, specific viscosity divided by concentration and concentration divided by turbidity provides interesting means of studying the solubility characteristics of the dissolved polymer, and eventually may lead to conclusions about the average shape of the macromolecules in extremely dilute solutions.

Factors Influencing the Brittle Point of High Polymers, *R. S. Spencer and R. F. Boyer (Dow Chemical Co., Midland, Mich.).*

Most of the brittle point tests in current use may be characterized as requiring a certain amount of deformation of the sample in a fixed time interval. Three mechanisms may supply this deformation: (1) ordinary elasticity, which makes a small contribution; (2) high, or rubber-like, elasticity; and (3) viscous flow. The brittle point test can be analyzed in terms of these three mechanisms and the following definition of brittle point was arrived at: The brittle temperature is that temperature at which the time interval necessary to produce the required deformation is just equal to the time interval allowed by the test. From the consideration of this definition it was seen that requiring more deformation, or allowing less time, will raise the brittle temperature, which has been found to be true.

A semi-quantitative treatment of the effect on brittle temperature of variations in molecular weight was made with the aid of the Flory melt-viscosity equation, which treatment showed that a linear relationship existed between the square-root of the molecular weight and the reciprocal of the brittle temperature. A similar treatment of the effect of added plasticizer showed that a linear relationship existed between the square-root of the weight fraction of polymer and the reciprocal of the brittle temperature. Both of these predictions were confirmed experimentally.

Relations Between Stress, Strain, and Temperature in a Pure-Gum Vulcanizate of GR-S, *Frank L. Roth and Lawrence A. Wood (National Bureau of Standards, Washington, D. C.).*

Stress-temperature relations at constant elongation and at constant length have been studied in a pure-gum vulcanizate of GR-S. Such studies yield information useful for calculations involved in the theory of its elastic behavior, and furnish practical data regarding its tensile properties at different temperatures. The compounding recipe was: 100 parts by weight of GR-S, 2 parts of sulfur, 1 part of zinc oxide, and 0.5 part of zinc dibutyl dithiocarbamate.

In order to minimize the effects of relaxation of stress during the observation of stress-temperature relations the specimens were first held at constant length and constant temperature for one or two hours to allow the stress to approach a constant value. These values of stress were used to plot a stress-strain curve. The stress-temperature relations observed for temperatures below the relaxation temperature were linear and reproducible on successive runs of increasing and decreasing temperature. When the temperature was raised above the relaxation temperature straight lines were not obtained since farther relaxation occurred at the higher temperatures.

The intercepts at the absolute zero of temperature for the lines obtained below the temperature of relaxation are useful in evaluating the internal energy changes. The intercepts of the lines representing the experiments at constant elongation were found to be negative. The absolute values were of the order of 20 percent of the total stress for elongations up to 100 percent, and increased to about 30 percent of the stress at the highest elongation, which was about 150 percent.

A Molecular Theory of the Viscoelastic Behavior of an Amorphous Linear Polymer, *T. Alfrey (Monsanto Chemical Co., Springfield, Mass.).*

The kinetic theory of rubber elasticity is extended in two respects. First, the distribution of relative displacements of every chain atom is considered, not merely the distribution of relative chain-end displacements. Second, the rate of approach to elastic equilibrium, as well as the equilibrium itself, is considered. As a first approximation, it is predicted that a linear amorphous polymer will possess a distribution of elastic retardation times of the form

$$J\ (T)\ dT = \frac{(C + D \ln T)}{T}\ dT,$$

where C and D are constants characteristic of the material.

Electrostatic Properties of Rubber and GR-S, *R. S. Havenhill, H. C. O'Brien and J. J. Rankin (St. Joseph Lead Co., Josephtown, Pa.).*

A new "Electrostatic Modulator" for measuring the electrostatic charges on various materials is described in this paper. In this apparatus the electrostatic lines of force established between the charged specimen and the grid of an audio frequency amplifier are cut or modulated at audio frequency by a motor-driven fan. The resultant alternating current voltage is amplified and measured on a meter in the output circuit. This device, in conjunction with a mirror surfaced metal plunger system for contacting the sample, has been used to measure the contact potential of various rubber and GR-S compounds.

Data are shown on both rubber and GR-S compounds, and they bear out the formulation of an "Electrostatic Contact Potential Theory of Reinforcement" in which reinforcement is explained on the basis of contact potentials and resultant electrostatic forces set up between the rubber and the reinforcing agents.

By the application of this theory, organic materials, which have a highly positive charge, such as polymerized Trimethyldihydroquinoline and Flectol H, have been found to increase the tensile of GR-S pure gum type compounds as much as fivefold and to nearly double the tensile of high zinc oxide GR-S compounds.

Speed of Retraction of Rubber, *R. B. Stambaugh, Margaret Rohner and S. D. Gehman (Goodyear Tire & Rubber Co., Akron Ohio).*

A method of measuring the speed of retraction of rubber is described which utilizes an electronic timing circuit with photocell input. The results include measurements of the speed of retraction of Hevea and synthetic rubbers as a function of elongation, temperature, carbon black loading, and cure. They are discussed both from the standpoint of the new information which they give in regard to rubber structure and high elasticity as well as their practical application to evaluate quality and cure. High speed photographs are included which are of interest in showing the manner in which rubber retracts.

Some Physical Properties of Elastomers at Low Temperatures, *H. E. Greene, C. W. Harris and D. L. Loughborough (B. F. Goodrich Co., Akron, Ohio).*

The extreme importance of choosing testing conditions to be comparable with the service expected of an elastomer is discussed from the physical point of view.

The shapes of the modulus vs. temperature curve are interpreted on the basis of the non-equilibrium nature of the elastomer properties in the transition region between the elastic and the glassy state. Variations in the physical properties caused by changes in testing speed, sample shape, stress at which the modulus is calculated, and previous history of the sample are discussed. For a specific set of testing conditions, typical data are given for the elastic modulus, hysteresis, and set as a function of temperature for natural rubber, GR-S, polybutadiene, Butyl, and Neoprene FR. Examples are cited from a study of various softeners and loadings which show the influence of compounding ingredients on the rate of attaining equilibrium between stress and strain in the transition region. A few examples are given to show the effect of changes in the polymer molecule.

Simple and inexpensive testing methods are presented which permit a relatively rapid determination of the low temperature properties of rubber-like materials in tension. A detailed description of a small, low inertia tensile machine which is capable of recording both stress and strain from a single cable is given.

Limiting Law of the Reinforcement of Rubber, *Hugh M. Smallwood (General Laboratories, U. S. Rubber Co., Passaic, N. J.).*

The effect of the filler upon the modulus of compounded rubber has been calculated with the aid of some simplifying assumptions. From these calculations it is found that the increase in modulus, due to the filler, is directly proportional to the volume loading, and is independent of the particle size of the filler. The stress system in the vicinity of a spherical filler particle has also been calculated.

A series of experiments has been made to check these calculations. From the results of these experiments, it has been deduced that carbon black is flocculated in rubber; and that P-33, Thermax and Gilder's whiting, are completely dispersed in rubber. These last named fillers give increases in modulus substantially in agreement with the calculations. It has further been found that Kadox and XX zinc oxide give unusually large increases in modulus. These are ascribed to alteration of the type of cure of the rubber matrix. Catalpo clay showed excessive modulus because of high calender grain.

Some Low Temperature Properties of Elastomers, *F. S. Conant and J. W. Liska (Firestone Tire & Rubber Co., Akron, Ohio).*

A modification of the apparatus employed in measuring the Young's modulus of elastomers at low temperatures is described. The changes made in the apparatus permit the use of a simplified technique which can be adapted to routine testing procedure.

The effects of various softeners on the low temperature bending moduli and the brittle point temperatures of stocks based on four butadiene-acrylonitrile (B/A) type copolymers are given. It is shown that the softeners tested have the same relative effects in all four types and that a wide variation in low temperature properties is imparted to the stocks by the different softeners.

Bending modulus curves and brittle point temperatures are given for typical test stocks based on Thiokol FA, and "mass" and "emulsion" polymerized polybutadiene.

It is shown that continued exposure to low temperature affects the Young's modulus of some but not all typical vulcanizates. Data are presented showing this effect on an uncured Hevea gum stock held at 0° C. Certain softeners have been found to induce time effects in one of the B/A type stocks, which exhibits no crystallization, and hence no progressive stiffening in the absence of the given softeners.

A method for measuring and evaluating creep under dead load at low temperatures is presented. Accompanying data indicate that in the case of those stocks tested, the creep constant defined reaches a maximum at a definite temperature which is a characteristic of the given stock.

The Thermodynamics of Rubber at Low Extensions, *D. R. Elliott and S. A. Lippmann (U. S. Rubber Co., Detroit, Mich.).*

On analyzing their own data, Meyer and Ferri have concluded that at small extensions, rubber is an ideal elastomer according to the definition that the partial derivative of the intransic energy with respect to the length, at constant pressure and temperature, vanishes. Further analysis of Meyer and Ferri's data does not sustain their conclusions. If, however, the relation is taken as a new criterion for an ideal elastomer, Meyer and Ferri's data do indicate that rubber is ideal, at least for extensions up to 166%. The new criterion implies that the valence angles do not store an appreciable amount of energy when the rubber is stretched. However, both the molecular orientation and the interatomic displacements do influence the energy required for extension.

Transition Phenomena in High Polymers, *W. O. Baker (Bell Telephone Laboratories, Murray Hill, N. J.).*

Organic polymers of high molecular weight exhibit a variety of changes in state, which profoundly affect their physical and mechanical properties, and are thus of both theoretical and practical interest. Temperature and external stress are, as expected, the principal determinants of these transitions. Because van der Waals' forces are of relatively short range compared to metallic or ionic bonds, delicate and subtle changes in structure govern the physical behavior of natural and synthetic high polymers.

I. "Second Order" Transitions: The most general transition of essentially linear macromolecules (with which we are chiefly concerned) is between high elasticity and ordinary elasticity; room temperature is above this transition point for rubber but is below it for polystyrene. These changes in state occur unsharply, as indicated by changes in slope but not discontinuities in the curves of specific heat, coefficient of thermal expansion, dielectric constant, modulus of "elasticity," etc., vs. temperature. They have been associated for the past decade with the "second order transitions" of P. Ehrenfest.* A great deal of their quantitative interpretation remains to be done. For instance, evaluation of the relative importance of forces betwen molecules compared to those within molecules (rotations around primary valence bonds) in restricting rotational motion in the polymer chains below these transitions is unsolved. Nevertheless, onset of rotational motion of chain segments (about their long axes) as the temperature is raised through the transition range is a likely deduction from many experiments. Relatively small changes in chemical composition (but presumably large alteration in van der Waal's forces) can shift the temperature range of this transition from —80° C. (polybutadiene, polyisobutylene, natural rubber) to over 200° C. (cellulose derivatives).

II. First Order Transitions: A great many high polymers possess such geometrical regularity that at least portions of their long chains form ordered, crystal-like arrangements spontaneously above room temperature (polyethylene, polyesters, polvinylidene chloride), or especially under particular conditions of cooling or annealing (polyamides, cellulose triesters). Others undergo such ordering at lower temperatures (natural rubber). Some polymers "crystallize" under external stress such as stretching, at higher temperatures than those at which they order spontaneously (natural rubber), or only under stress, and not spontaneously at any temperature (polyisobutylene). Many of these transitions, which X-ray and electron diffraction show to involve quite sharp changes in local order, have been lately found to possess high latent heats, or discontinuities in heat content-

temperature curve, they seem to be first order transitions, and are strikingly abrupt considering the great range of molecular weights, and presumably, of overall chain configurations, contained in the polydisperse samples investigated. The low temperature (or ordered) side of these first order transitions is distinguished by the strongest molecular interaction of any state of polymers. Indeed, the molecular packing appears often to be so efficient that characteristic high polymeric strength and toughness are attained at one tenth the average molecular weight of similar molecular structures which do not show such first order transformations (polyethylene, ordered, compared to polystyrene, disordered). Recent studies on simple condensation polymers suggest that either the regular occurrence of points of strong van der Waals' attraction along a given chain (polyvinyl alcohol, polyamides, polyesters, cellulose triesters, etc.) or such composition that the chain has a sort of rod-like cylindrical symmetry around its axis (polyethylene, polyvinylidene chloride, polyisobutylene) is necesary for transformation to states of high local order. Thus, while virtually all chain polymers show the "second order" transitions first noted, only those of requisite structure exhibit first order phenomena.

III. Mixed Transition Phenomena: Transitions or structure changes within phases defined by the prime first order transformation "crystal"—"liquid" have now also been reported. Those caused by temperature may be of second order, although this is not yet certain. Those associated with both temperature and external stress are still more specialized, as illustrated by the $\alpha - \beta$ keratin transition and the recent analogy to it produced with synthetic substituted polyamides. These instances appear also to be related to understanding of the α and β forms of gutta-percha, wherein the transition seems to involve change in chain configuration by twisting about primary valence bonds (not to be confused with actual oscillations about such bonds, as on the high temperature side of a "second-order" transition).

IV. Present Status of Study of Transitions: Accurate observations and conceptions of the basic structures and free energies concerned comprise the present study of transition phenomena in plastics. Attempts at detailed theories do not yet justify review. Evidently, transition temperatures influence greatly the particular utility of high polymers in the form of rubbers, plastics or fibers. (Perhaps astrophysicists should realize that rubber tires are not flexible on cold planets, while bomber noses would stretch like balloons in worlds above 100° C.) Problems like the insolubility at room temperature of simple polymers such as polyethylene and polyvinylidene chloride have been enlightened by evidence that these substances gain sufficient rotational entropy in the solid to make dissolution thermodynamically unattractive. On the other hand, the decrease in entropy caused by orientation (fibering) of an already ordered polymer seems to be too slight to entitle orientation *per se* to classification as a separate state. Perhaps transition phenomena in high polymers are best summarized as being highly probable events, for, actually, a given polymer solid usually contains several states of order simultaneously, never being all ordered, nor entirely disordered, and these states are likely to be changing more or less continuously, much like the traditional changes in ancient glass. Thus, they are physically very imperfect phases indeed.

* Perhaps these transitions should be called "higher-order" or "Ehrenfest" transitions, since they include "anomalous first order," "diffuse," "lamda," as well as "simple second order," to follow the classification of Mayer and Streeter. *J. Chem. Phys.*, Vol. 7, 1019 (1939).

Systems with Superposed Viscous and Elastic Behavior, *A. V. Tobolsky (Princeton University, Princeton, N. J.).*

A brief summary of the historical aspects of this subject will be given. The contributions of Maxwell, Voigt, Boltzmann and other classical authors will be related to the recent work of Kuhn, Bennewitz, Simha, Leaderman, etc. It will be pointed out that the classical "theory" is mainly a formalism. Non-Newtonian flow behavior, high elasticity and other important phenomena are not even considered in the classical theory. Recent work has been concerned with attempts to find the underlying basis of the classical formalism in terms of theories of molecular structure. The remainder of the talk will be devoted to a description of some theoretical researches on the molecular basis of elastic-viscous behavior developed at Princeton, and to the results of joint experimental-theoretical researches undertaken by the Firestone Tire and Rubber Company and Princeton University.

A molecular theory for a "unit process of deformation" will be presented which describes the behavior of such a unit under the action of a local stress. The problem of combining the behavior of these deformation units will be considered for the case of polymeric substances, particularly three-dimensional polymers.

The network structure of these substances and the nature of the network junctures will be emphasized. The theory of rubber-like elasticity and its relation to network structure will be considered. The three characteristic regions of stress-time behavior in vulcanized elastomers will be related to their characteristic structural features.

Five general classes of rheological experiments will be described: plastometry, relaxation of stress at constant extension, creep under constant load or constant stress, breaking experiments and vibration experiments.

Plastometric experiments (in machines such as the Mooney or Dillon plastometers) provide the most striking example of non-Newtonian behavior. Application of the theories developed are only partially succesful for quantitative description of the phenomena. The underlying experimental and theoretical difficulties will be examined.

Application of the generalized relaxation theory to rubbers (and many other substances) in the range of rubbery elasticity is again only partially successful. Part of the difficulty lies in obtaining uniform data that cover a wide frequency range.

Experiments on relaxation of stress at constant elongation have proved very fruitful from both the experimental and theoretical point of view. Important additions to our knowledge of all three stress-time-temperature regions are indicated.

A discussion of the region of chemical destruction of the primary bond network in terms of chain scission and cross-linking will be presented. Data on continuous and intermittent stress relaxation will be interpreted quantitatively.

Similarly the region of secondary bond relaxation and the region of relative thermodynamic equilibrium will be described. Data on continuous and intermittent creep will be shown to yield much the same information as data on continuous and intermittent stress relaxation. Certain other experiments which correlate with the results of creep and relaxation data will be explained.

Kinematic Errors in Bobbin Drives on Roving Frames, *S. L. Gerhard (U. S. Rubber Co., New York, N. Y.).*

The mechanisms employed for turning the bobbins as they traverse up and down produce gradual fluctuations in the rotational velocity of the bobbins. Details of the trigonometric calculations of these fluctuations are described for three different mechanisms. Curves are shown depicting the fluctuating displacements and velocities. The percent fluctuation or error in velocity is practically linear with respect to the position of the bobbin in the traverse. The percent variation in roving size is equal to the percent error in velocity, and amounts to approximately 1%, according to theory. With this indication that the kinematic errors in the bobbin drive may be responsible for some of the variations in the roving size, the calculations were carried further, assuming that the roving was originally uniform. Details are shown for calculating the size variations as a function of length along the roving as unwound from the bobbin. The variations follow a quasi-periodic saw-tooth curve, increasing in amplitude and frequency toward the barrel of the bobbin. The significance of these variations when rovings from two bobbins are combined in latter operations is described.

Control of Elongation in Highly Stretched Cotton Tire Cord, *Howard J. Philipp and Carl M. Conrad (Southern Regional Research Laboratory, New Orleans, La.).*

At the present time almost all cotton tire cord is subjected to some stretching treatment in order to improve its strength and stretch characteristics. However, it has not been possible to take full advantage of the maximum potential strength obtainable by stretching treatments, because they reduce the elongation to an extremely low value. Tires made from such low-stretch tire cord have low impact strength while tire cord with too much stretch leads to tire growth. Therefore, a compromise had to be made between strength and elongation, sacrificing part of the maximum strength. In this paper a new dual-stretching process is described which allows the control of elongation of cotton tire cord independently of the strength and permits the production of a cord which combines almost maximum strength with optimum elongation. The method consists of two steps. During the first step the cord is given increased strength by simultaneous application of tension, moisture, and heat. During the second step the elongation is adjusted to the desired value by the application of moisture and tension without heat. The degree of swelling and of stretching during the second phase determines the elongation of the improved tire cord.

The Influence of Velocity Gradient on the Relation Between Viscosity and Concentration in Cuprammonium Solutions of Cellulose, *W. James Lyons (Southern Regional Research Laboratory, New Orleans, La.).*

The numerous equations which have been hitherto employed to relate the viscosity of solutions of high polymers to the concentration of the solute, have neglected to recognize explicitly the influence which velocity gradient (rate of shear) has upon the observed viscosity of non-Newtonian liquids. Consequently, the theoretically important, intrinsic viscosity, calculated on the basis of these equations, from data obtained on a solution in the anomalous region, is found to have a different value for each velocity gradient prevailing during measurement. A modification of the Baker-Philippoff equation has been developed empirically to compensate for the velocity-gradient effect. This new equation has been found to agree well with data on cuprammonium solutions of cellulose in concentrations below 0.5 gm per 100 ml.

Electrical Anisotropy of Xerogels of Hydrophile Colloids. II, *S. E. Sheppard and P. T. Newsome (Eastman Kodak Co., Rochester, N. Y.).*

Small circular disks are cut from sheets of polymeric materials which have been stretched to 100 per cent or more elongation. The rotation of the disks in an alternating electric field had been found to depend on the hydroxyl content of the material and/or the amount of adsorbed water. Materials containing no hydrophile groups are inert. Polyvinyl alcohol responds independently of humidity but partially hydrolyzed polyvinyl acetates show moisture susceptibility. New data have been obtained on the effect of molecular weight (chain-length), of elongation, and relation to optical birefringence.

Determination of Molecular Weight Distribution in High Polymers by Solubility Methods, *D. R. Morey and J. W. Tamblyn (Eastman Kodak Co., Rochester, N. Y.).*

In general, the precipitation of a heterogeneous polymer by the progressive addition of a non-solvent to its solution results in the precipitation of the higher molecular weight components first, due to their lesser solubility as compared with the more soluble smaller molecular weight components. This variation of solubility with molecular weight is dependent upon the solvent-precipitant system chosen, and may for some systems be zero or may even be reversed so that lower fractions are less soluble. The first step is to choose the proper system which will produce large solubility-molecular weight variations. Since the precipitation of the hetero-polymer is followed by readings of scattered (or transmitted) light, the system must also permit an interpretation of such readings into mass of polymer precipitated. Next, the law relating the composition of the mixed solvent at the point of polymer saturation (denoted by P_p) to concentration and molecular weight is found by calibration with known concentrations and weights. From this law a saturation point chart is constructed. By its use the relative amounts of the separate molecular weight species are obtained, the amounts being chosen to satisfy the optically obtained precipitation versus P_p curve. The method is illustrated by its application to cellulose acetate-butyrate. Distributions of blends of fractions are obtained and found to agree with gravimetric data.

Fractionation, Viscosity and Osmotic Pressure Studies on Cellulose Esters, *J. W. Tamblyn, R. L. Tichenor, D. R. Morey and R. H. Wagner (Eastman Kodak Co., Rochester, N. Y.).*

The curve of intrinsic viscosity $[\eta]$ vs. molecular weight (osmotically determined) was obtained for cellulose acetate butyrate separated into 21 fractions by fractional precipitation. These fractions were then grouped into four large groups and each of these refractionated. The $[\eta]$ vs. ^{n}M curve obtained on these refractioned fractions agreed with the first curve over the lower molecular weight range, but from ^{n}M = 100,000 and higher, deviations due to substantial inhomogeneity occurred. A single fractionation thus does not yield sufficient homogeneity in the higher molecular weight range. The characteristic curve relating the intrinsic viscosity and the number-average molecular weight of these essentially homogeneous fractions is also the relation between the intrinsic viscosity of a sample of any distribution and its viscosity-average molecular weight. Unfractionated cellulose acetate butyrate was degraded to various extents by heating and by ball-milling and the $[\eta]$ and ^{n}M values determined. A plot of these points resulted in a line for which a simple expression can be found. Thus, from a single viscosity measurement, it is possible to obtain a true number-average on any similarly degraded sample of this material. The fact that these points fall on a line rather than in random scatter indicates that the degradation processes in this case result in new distribution curves for which the ratios of viscosity- to number-average conform to a definite pattern. Samples of the same cellulose ester were fractionated by the usual precipitation method, but with initial concentrations of 2.0 per cent and of 0.05 per cent, to study the effect of this initial concentration upon fractionation efficiency. The gravimetric distribution curves were alike within the limits of error, showing that there is nothing to be gained by the use of low concentrations in fractionation procedure.

Comparison of the Structures of Stretched Linear Polymers, *M. L. Huggins (Eastman Kodak Co., Rochester, N. Y.).*

Published x-ray data from crystalline selenium and tellurium and from stretched sulfur (amorphous), polyethylene, polyisobutylene, polyvinyl alcohol, polyvinyl chloride, polyvinylidine chloride, polyoxymethylene, polyoxyethylene, polyethylene disulfide, polyethylene tetrasulfide, and polyphosphonitrile chloride are compared. In most cases the experimental identity distance in the direction of the chain axes and the expected interatomic distances and interbond angles are found to be in agreement with the assumption that the chain atoms form a regular spiral, unidirectional in each chain and of uniform pitch. Apparent exceptions are briefly discussed.

CONCILIATION —And the Rubber Industry

By DR. JOHN R. STEELMAN

Director,
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Washington, D. C.

One of the quietly-performing and most efficient government agencies is the Conciliation Service of the U. S. Department of Labor. Although brought to the fore only in recent years because of the increase in labor-management disputes, the Service is more than thirty years old. In 1943, the Service handled 21,775 cases embracing over 11,000,000 workers. In the same year it handled 285 situations involving 199,020 workers in the rubber industry. To give rubber manufacturers a clear picture of what the Conciliation Service represents, how it works, and the results it usually secures, we asked Dr. Steelman to write this article.

EVENTS since Pearl Harbor have given a new character to the rubber industry, and whether or not we Americans resume our former extensive use of natural rubber, the influence of synthetics will not be lost. In much the same way, a more advanced attitude toward industrial relations has come about under the pressures of wartime necessity.

Manpower problems have emphasized the importance of harmony with the realization that smooth-working arrangements between management and labor offer one of the surest means to increase wartime output. By the same token, disputes that drag along almost invariably hamper production, whether or not the controversy leads to an actual work stoppage.

Many of us are apt to think that these are purely economic disputes—controversies over wages and hours, paid vacations, and other economic issues. Others, however, are looking beyond these causes to something deeper and more fundamental. They see that harmony between management and labor is essentially a human problem very close to each one of us. Respect for human personality is one of the key factors in resolving or preventing labor disputes.

Record of Conciliation Service

During the past calendar years, the Conciliation Service was called on to handle 285 situations involving 199,020 workers in the rubber industry. Of this total 228 were active disputes embracing 185,310 workers. In the eight months from July 1, 1943, through February, 1944, there were 21 strikes reported to the Service with 5,706 rubber workers involved.

The record for all industry last year shows that the Conciliation Service settled 15,051 disputes involving nearly five and a half million workers. Other situations handled brought the year's total to 21,775 cases embracing 11,083,591 workers.

How does the Service go about its job settling some 40 disputes each day, spread more or less from coast to coast? While the war has brought many new and urgent problems, the task of settling labor-management disputes by voluntary methods of conciliation is not new. The Service has been doing just that since it was set up more than 30 years ago.

Techniques have been improved and personnel has expanded, but the basic principle of voluntary action is unchanged. Mutual agreement is the cornerstone of conciliation. At present some 300 Commissioners of Conciliation deal with the situations that arise each day. In line with current governmental procedure, the Service has been decentralized into five regions with headquarters in New York, Washington, Cleveland, Chicago, and San Francisco. The activities of the Commissioners are directed from these offices, each of which has its own regional director. An administrative staff in Washington coordinates this work at the national level.

Personnel Carefully Selected

The men who must diagnose each case and suggest the correct prescription for industrial peace have been carefully selected. They have been former personnel managers, lawyers, engineers, educators, or union leaders chosen for their knowledge and experience in the field of labor-management relations. In assigning these men to particular cases the Commissioner's own familiarity with the industry involved is always considered as well as the existing case load within his region.

In the majority of instances the Conciliation Service steps in at the direct request of management, labor, or the public. Occasionally, when it is believed to be in the public interest, the Service offers its assistance without waiting for a request. In the early days management was at times chary about calling on the Service. Now, however, about as many requests are received from management as from labor.

Dealing as they do with so many controversial situations, Commissioners must not only exercise tact and good judgment, they must avoid any appearance of taking sides. A record of nearly 25,000 disputes settled in the two years since Pearl Harbor is the best proof of their impartiality.

After he has been assigned to a case the Conciliator's first job is to get a clear, rounded picture of the whole situation—the points at issue and the undercover animosities that may be blocking the way to any real discussion. As a rule he begins by talking to the parties separately and then attempts to arrange a joint conference. The location of this meeting is important—it should be held at some spot away from the actual scene of the dispute if this is at all feasible.

Because they usually win the confidence of both sides, Conciliators often know what each side is willing to concede. These off-the-record talks are not aired at joint meetings but they are invaluable to the Commissioner who must steer the course of negotiations past the numerous hidden reefs to a mutually satisfactory settlement.

Conciliators Use Tact

On paper this conference table method sounds like a very elementary procedure. But when a dispute has reached an apparent deadlock and tempers are short it is not easy to create an atmosphere of mutual understanding where frank and open discussion can take place. It requires patience and determination as well as ingenuity. Nevertheless, the great bulk of disputes are settled through such a meeting of minds—with the friendly guidance of an impartial peacemaker or "idea man."

Remembering that Conciliators have no law to enforce, except the laws of reason and common sense, let us get a close-up of their methods from an actual case history. This particular dispute had its beginnings in a new productive process not covered by the existing union contract. The department involved was not large but its fifty workers were essential to the production of vital war material. They had been under pressure to get out more of a certain coated fabric before the company introduced its new process. There had been some sharp exchanges between the shop steward and the supervisor and the men were jumpy.

Before the new process started, the supervisor offered the men a pay scale based on a piece rate which he had figured out instead of the flat rate they had been getting. The shop steward took one look and his eyes blazed.

"Why don't you ask 'em to work for nothing? That would save bookkeeping," he shouted.

"For nothing?" the supervisor exclaimed. "Why they'll make more this way than they did before—and won't have to work as hard."

"You ought to know," the shop steward was sarcastic. "According to you, the boys loafed most of the time anyway—that's what you have already told the front office."

The supervisor denied that charge and added that they knew how to handle "guys like you" in the Army.

From that point on discussion was useless. By quitting time the whole plant knew the story and the supervisor had a threatened walkout on his hands. Next morning the plant superintendent put in a hurry call to the Conciliation Service in Washington.

Wires buzzed and that same afternoon a Conciliator reached the scene. The atmosphere in the plant was electric with suppressed excitement, like the tension that grips a street crowd during a bad accident. According to the shop steward his men in the coated fabric department were ready to "hit the bricks."

"Let 'em walk out," the supervisor told the Conciliator. "The front office will back me up."

It took persuasion even to arrange a joint conference for eight o'clock that evening in a hotel conference room.

After he called the meeting to order the Commissioner asked each side to present its case. They did not agree at all about how much the men could make under the new piece rate, but the speakers did avoid making personal remarks. The company insisted that the men would be able to earn more under the piece rate incentive plan than on an hourly rate and that this was the only way the company could be certain to meet its quotas. The union held to its belief that the men would earn less and that the new plan would be a method of "speed-up."

After some discussion during which both sides had an opportunity to express their opinions, the Commissioner asked management if it had considered the possibility of giving the workers a guaranteed minimum hourly wage. Management said it had not but that it would be agreeable if that would help solve the problem. The Commissioner then asked labor how it felt about this proposal. The labor representative said that if management guaranteed them the hourly rate which they felt was fair that this would settle the dispute.

That simple proposal and its acceptance cleared the atmosphere and a new agreement was signed within an hour. It was an obvious solution, like the answer to so many disputes that come before the Conciliation Service. The thing to remember is that this controversy grew out of a commonplace human situation where each side had a chip on its shoulder from the beginning. With war pressures adding to the burdens of both management and labor, conciliation is a round-the-clock job for many Commissioners.

Not all disputes are settled by conference table methods. Some hinge upon technical questions. The Conciliation Service has a staff of Commissioners with technical training who are equipped to make studies and findings of fact upon the joint request of the parties. Such findings are not presented to the parties as final and binding but rather for their use for further bargaining.

The type of study or finding of fact made by the Technical Staff, of course, depends upon the question involved. If the problem involves work load, a time study may be made or the incentive plan reviewed. Various other problems may require these technically trained men to assist in preparing job descriptions to be used as the basis of classifying employees or to help the parties with a job evaluation project. Last year the Technical Division extended its work into a total of thirty-five industries.

Arbitrators Well Trained

Commissioners of Conciliation often suggest technical aid when an agreement has not been reached through conference table negotiation on particular points of a technical nature. The services of the Technical Staff may also be requested by writing to the Washington Office of the Service.

The Service has a staff of Commissioners with specific arbitration training who hear cases and make awards when jointly requested by the parties. This is, of course, voluntary arbitration as such cases are accepted only when the parties have voluntarily agreed

to accept the decision of the arbitrator. During this war period, the wage issues in such awards are subject to review and approval by the National War Labor Board.

During the past year the Service appointed arbitrators in 1,115 cases. These awards were rendered impartially and on the basis of evidence rendered. They were almost all well received by both labor and management and the wage awards, with only a few exceptions, were unanimously approved by the respective Regional War Labor Boards.

When all of the issues of a case involving the war effort have not been settled by a Commissioner of Conciliation, the case is considered for certification to the National War Labor Board. In the eight months ending February 29, 1944, it was necessary to certify 34 cases involving rubber workers to the Board.

This outline of conciliation procedure makes it plain that the Service offers no cure-all for industrial disputes or even a set formula to guide either party. Human relations are too varied to handle by rule of thumb. What the Service does offer is the willing assistance of men who have watched the wheels go round and who know how to synthesize industrial peace from the human elements that make for discord. Not every "mix" is successful, but the record is good enough to invite the ready participation of management and labor in a process that seldom fails.

Citrus Pectate Pulp in the Packaging of Synthetic Rubber

SYNTHETIC rubber is stored and shipped from the manufacturing plants to the processing plants in paperboard boxes or multiwall paper bags. It possesses a decidedly greater tendency to stick to the package than crude natural rubber. This stickiness combined with a tendency to flow complicates packaging.

Coatings are used to prevent sticking and are therefore known as anti-sticks. One of these is clay applied to form a dry film on the inside surfaces of the paper box or inner ply of the bag, but clay is dirty and not altogether satisfactory as an anti-stick. Another is a slick, hard varnish which adheres strongly to the paper but is supposed to avoid the sticking of talc dusted synthetic rubber because of the smooth surface. This system is more expensive than the clay, and still is not satisfactory.

Making "Anti-Stick" History

A citrus product known as Pectate Pulp is making "anti-stick history" by serving in a new and particularly efficient manner. The Goodyear Agent of Rubber Reserve Company made the initial application to synthetic rubber, the general anti-stick properties of the pectate having been previously demonstrated by California Fruit Growers Exchange research men. A film of pectate pulp is applied to the paper in the form of an aqueous dispersion containing some sodium phosphate. It adheres as a superficial and extremely thin film yet effectively prevents contact of the rubber with the paper. The pectate pulp film then strongly adheres to the synthetic rubber, or rather the rubber, as is its nature, strongly adheres to the pectate pulp film as it does to any other surface. However when the package is emptied the pectate anti-stick film cleaves from the paper carying through with the rubber as a minute and entirely innocuous constituent. Thus the pectate pulp anti-stick complies with, rather than resists, the natural tendencies of the synthetic rubber.

Pectate Pulp was a development of the California Fruit Growers Exchange several years back as a result of effort through its Research Department to arrive at a better balance between agricultural, food and drug, and industrial outlets for a certain raw material. This potentially large and important material consisted of fresh, raw peel residue of citrus fruits after juice and essential oil had been recovered. Industrial outlets particularly were desired and the most promising single ingredient for such use appeared to be the pectic substance.

Whereas pectic acid and pectates of a type giving relatively amorphous-granular precipitates with alcohol have long been known and are used for some purposes, discovery of a new fibrous form was the turning point of this investigation. A method of "pectation" was devised whereby the large molecular size of the native protopectin of the peel was preserved in an insoluble complex pictured as consisting of sodium calcium pectate and cellulose. Being insoluble and free pressing at this stage it can be repeatedly washed and pressed with but little loss and then dried and ground.

Pectate Pulp Is Dispersed

At the point of use a minor addition of sodium phosphate is made to hot water and the pectate pulp is dispersed by strong agitation. Cleavage of the complex takes place and there results a finely divided suspension of cellulosic material in a collodial solution of sodium pectate. This sodium pectate, filtered and then precipitated with alcohol, yields a fibrous tangled mass.

Both the pectate and the cellulose components in the aqueous dispersion contribute materially to the formation of the anti-stick film on paper, making the material particularly effective. Thus the researchers of the California Fruit Growers Exchange together with factory trials of the Los Angeles Goodyear Synthetic Rubber Corporation, agent for Rubber Reserve Company, promise not only a more effective anti-stick but the cost will be reduced as compared with the present practices. *(Note: The above material was contributed by the California Fruit Growers Exchange, Research Department, Ontario, California, to the National Farm Chemurgic Council, Columbus, Ohio).*

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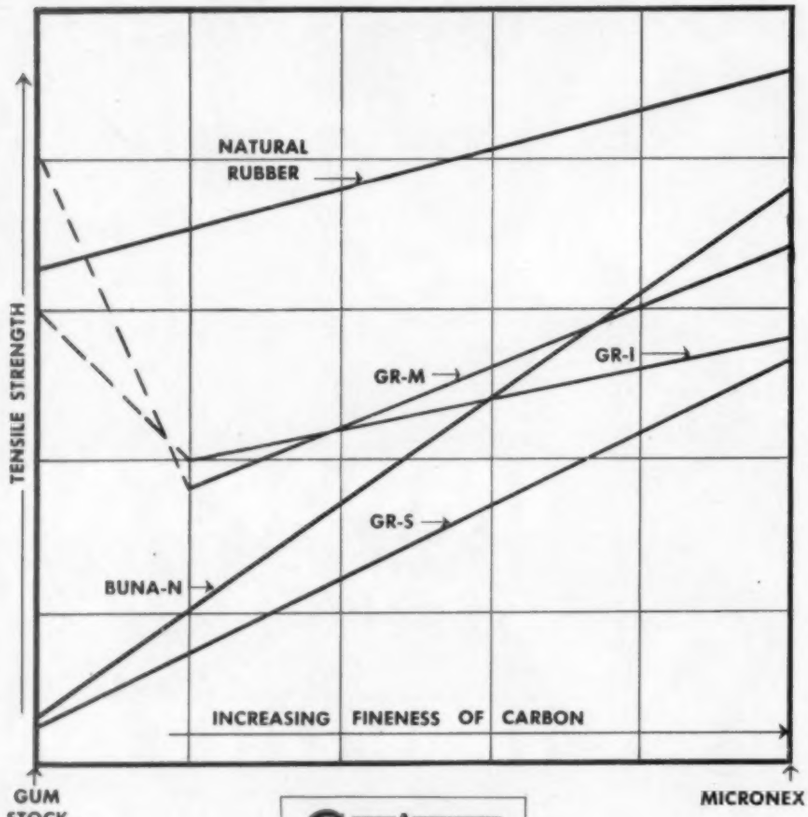

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Editorials

London Meeting

ACCORDING to reports emanating from Washington in mid-June, the U. S. Department of State, which recently appointed a Rubber Advisory Panel, had decided to make no commitments on any international agreement of any kind covering the post-war status of rubber until 1945 or 1946. The reason for this decision, according to the same reports, was attributed to the fact that the rubber problem was far too complex to arrive at any conclusions much before that time. Contrariwise, just as this issue was going to press, the State Department announced that an American group would meet with British and Dutch groups in London late this month and early in August to discuss the post-war status of crude and synthetic rubber.

It should be emphasized immediately that the State Department's announcement indicated that the London talks would be purely exploratory in nature and were intended to formulate a program of specific studies which could lead to definite conclusions some time in the future. As reported elsewhere in this issue, the Rubber Advisory Panel, recently appointed by the Department, had organized a "task force" for the purpose of making similar studies. The first problem facing this "task force" was the determination of the possible and potential world demand for rubber—crude, synthetic and reclaim—in the post-war period. Although it is generally conceded that this demand will be far greater than any which existed in the prewar period, no estimate has been made by any official source.

The London talks, which will certainly be criticized in certain quarters, are bound to result in concrete suggestions concerning world-wide collaboration which, as has been stated in these columns many times before, is essential, both from the standpoint of the domestic rubber manufacturing industry and world economics. In view of the caliber of the executives forming the American group which will participate in the London talks, there is very little likelihood that any decisions will be reached which will not be favorable to the American rubber manufacturing industry or at least which will not give that industry full recognizance. The group is composed of both industry and government officials familiar not only with the problems of rubber manufacture but with plantation problems as well. For example, P. W. Litchfield of Goodyear and Harry E. Smith of Manhattan Rubber, both well acquainted with the problems of rubber cultivation, production and shipment, are members of the Committee. Government officials on the Committee are also well steeped in rubber lore.

A good deal of speculation must of necessity enter into the London talks. Whereas the potential of the synthetic rubber industry can now be determined statistically, the condition of the rubber plantations in the Far East is a big question mark and will remain so until the Japanese are actually driven out of Malaya and Sumatra. According to Sir Eric Macfadyen, noted British rubber expert, a good deal will probably have to be done before these plantations are restored to their 1941 condition. Cultivation will have been neglected. Malaria may be ripe. Buildings are likely to be dilapidated. Machinery will have to be completely replaced. Experienced planters will be needed to repair the damage. As he sees it, "we shall be lucky if wet get fairly straight within a year or two."

Despite all of the problems which face the various groups which will meet in London, these exploratory talks are most certainly a step in the right direction. Although no commitments will be made by any nation as a result of these talks, the groundwork will be laid for an international organization which will oversee rubber in the post-war period. The domestic rubber manufacturer is not afraid of international control of rubber, providing he is assured of a steady supply at a reasonable, non-fluctuating price.

Guayule Victory

AFTER hearing an impassioned plea to continue the Guayule Rubber Project from a special committee headed by Representative Poage (Texas), appointed to investigate the entire project, the House of Representatives reversed its previous decision and voted overwhelmingly by 5 to 1 to continue the project. This approval assured the project an additional appropriation of over $3,000,000 to continue research, construction of new milling facilities, and cultivation. It would have been an economic blunder to have liquidated the project at this time as originally urged in the House. Not only would the project not have been given a full opportunity to show the results predicted for it by rubber experts but the millions invested in it would have gone for naught. Guayule has a definite place in the rubber manufacturing field. It is to be hoped that not only will the project be continued for another year but that it will be supported for some time after the war so that the full benefits of the original program may be reaped by industry.

CURRENT NEWS OF THE MONTH

WAR DEPARTMENT TAKING STEPS TO ASSURE INCREASED PRODUCTION OF MILITARY TIRES

The serious situation in military tire production, which is reported to be declining due to the manpower shortage, already stressed by Paul V. McNutt, Chairman of the War Manpower Commission, as reported in the previous issue, was re-emphasized early this month when a new series of conferences with management and labor was held in the Akron area. Participating in the conferences were Rubber Director Bradley Dewey and Lt. Gen. William S. Knudsen, ace production expediter of the War Production Board. The conferences spread over a three-day period on July 6, 7, and 8, and were marked by several announcements and actions aimed at taking up the lag in production. Hope was expressed by various officials that an increase in production in military tires may be expected shortly as the result of these actions.

Foremost among the actions taken as a result of the conferences was the decision by the War Department to release all men over 30 who formerly worked in any phase of heavy military tire construction. This decision was announced by Acting Secretary of War Robert P. Patterson, who promised the return of an unestimated number of former tire construction workers, particularly to the Akron area.

The new order contrasts sharply to the previous one which provided only for the release of skilled tire builders over 34. According to report, less than 200 tire men were released as the result of this order. The new order, however, takes in all men over 30 who were engaged in any tire production job—from milling to curing. Like the first order, however, it restricts release to service men who are still in the United States. These men will be released to the enlisted reserve.

The latest order also stipulates that the Army will release only those men whose former employers request their return, and telegrams to the rubber manufacturers requesting names of men were sent out by the War Department. Because of the drastic need for such workers, no difficulty along these lines was anticipated.

Return to Six-Day Week

While the Akron conferences were being held, it was learned that tire companies in the Akron area will shortly return to the uniform six-day week. The reason for this move, according to Major William H. Hogeland, tire production expediter of the Army Service Forces, is chiefly to combat absenteeism. Averaging between 6 and 7%, absenteeism is comparatively low in tire production, Major Hogeland said, but it is believed that it can be reduced further. According to charges made in other quarters, absenteeism in tire plants is said to run about 10%

The subject of absenteeism was one of the major points discussed by Col. Dewey and Lt. Gen. Knudsen with union officials during the Akron conferences. General Knudsen is reported to have indicated that tire production was approximately 30% behind schedule and a reduction in the absenteeism rate could reduce this percentage considerably. Union officials claimed that actual absenteeism in tire rooms is minor, compared to other sections of the factory, and that the real difficulty, other than manpower shortages, lay in the poor rates paid in the millroom and overlong delay in settling labor grievances.

At the conclusion of the conferences, it was pointed out that some 900 men are needed in the Akron area alone to bring tire production up to military requirements, and that the decision to release all men over 30 with some tire experience from the Army will help to meet this need. It was also indicated that if necessary truck tire production will be secured even if it proves necessary to hold down passenger tire production.

Hold Off on Rubber Accord

There is little possibility that any answer will be given to British-Dutch proposals for the formation of an international non-restrictive rubber agreement for many months to come, possibly not even until late 1945, according to reports emanating from Washington. It is strongly felt in both rubber and diplomatic circles that the United States should make no commitment until current studies on world supplies of natural rubber and the future of synthetic rubber are completed by the joint industry-government advisory committee recently named by the State Department.

American experts hold that there is no necessity for this country to make any hasty decisions as to postwar agreements as long as there is a scarcity of rubber. That situation is expected to exist until at least two years after the principal sources of natural rubber are recaptured from the Japanese.

Meanwhile, rapid advances in the synthetic field have enabled this country to produce rubber to the extent that it can compete with the natural rubber producers, whereas previously it has always been in the position of a consumer nation and could exert little or no influence in determination of distribution.

The first subject to be explored by the committee will be the synthetic field. In this connection it will be necessary to forecast ultimate disposition of synthetic plants now producing for war.

It is conceded that any estimate along this line must be dependent on opinions as to the possible growth of the synthetic rubber industry. If the synthetic industry develops as some experts believe it will and takes its own place in the competitive field, the entire postwar rubber situation will be changed.

The committee will also attempt to forecast future military requirements for natural and synthetic rubber on the basis of studies it expects to receive from the Army and Navy and which are now in the course of preparation. From industry sources it will receive forecasts as to

Division Meeting Off

The Fall Meeting of the Division of Rubber Chemistry, A.C.S., which was scheduled to be held in New York City on September 13, 14 and 15, has been cancelled. This decision was reached by the officers and directors of the Division in view of the fact that railroad facilities are already overcrowded, that Eastern seaboard ports will be even more crowded with military personnel and transportation of casualties from the new fighting fronts, and that the rubber industry cannot afford to have so many technical man hours spent away from the factories during this period. The Division meeting was scheduled to be held with the national meeting of the parent society. Insofar as can be learned at this writing, the national meeting will be held as scheduled.

postwar domestic consumption of the different types of rubber and will attempt to estimate what export markets, if any, will be available to American producers. This particularly depends on development of the synthetic industry.

Finally, the committee will seek to centralize all information which has been gathered by other Government agencies on the question of rubber. Although the British and Dutch are believed to be conducting somewhat similar studies of their postwar positions, there is little likelihood of any direct discussions between representatives of the three nations in the immediate future.

(EDITOR'S NOTE: It was announced on July 18 that an American group, headed by B. F. Haley, chief of the Commodities Division of the State Department, will participate in exploratory talks in London late this month and early in August with Great Britain and the Netherlands on postwar problems of crude and synthetic rubber. A tentative program of studies will be drawn. W. S. Lockwood, of the American Embassy in London, well known in domestic rubber circles, will represent the embassy in the discussions.)

Special Grades of GR-S

According to Circular No. 28, issued by the Rubber Reserve Co. on June 9, special grades of GR-S are now being produced in some of the government-owned copolymer plants and are now available for limited distribution to rubber manufacturers. These special grades have been assigned the following GR-S designations and are of the same type as standard GR-S, except as indicated:

GR-S—12: This grade has a Mooney viscosity between 65 and 75 (as compared with a Mooney viscosity for standard GR-S between 45 and 55) and tends to have a slightly higher modulus than standard GR-S.

GR-S—20: This grade has a Mooney viscosity between 39 and 45 and has a lower modulus and higher elongation than standard GR-S.

GR-S—85: This grade has Mooney viscosity between 90 and 110 and has a considerably higher modulus and lower elongation than standard GR-S.

GR-S—St: This grade is the same as standard GR-S and contains "Stalite" as the stabilizer.

Rubber Reserve will sell any of the foregoing special grades of GR-S at a price of 18½c per pound, plus a uniform freight charge of ½c per pound (which is the base price charged for standard GR-S), all such sales to be made, freight allowed, ex the producing plant upon the terms and conditions set forth in Circular No. 17. Manufacturers wishing to purchase such special grades of GR-S should address appropriate requests to the Sales Department of the Rubber Reserve Co., as provided in its Circular No. 27, each such request to specify the special grade desired.

Revise GR-S Specification

The standard specification for GR-S of the Rubber Reserve Co. was revised as of July 1, and all operators of GR-S plants have been advised that all GR-S shipped to warehouses must meet the new specification in the future. Complete copies of the revised specification may be secured by writing to the Rubber Reserve Co., Washington 25, D. C.

Included among revisions made in the new specification are the following: Limits for compounded viscosity and modulus at 300% elongation have been changed; Method for preparing the viscosity sample has been revised; E-T-A extract has replaced acetone extract and the test method for fatty acid, soap and ash has been revised; A highly-polished, hard chromium plated mold is specified and the use of mold lubricants prohibited; Instructions for the calculation of stress-strain properties have been made more explicit.

CHANNEL TYPE CARBON BLACK PLACED UNDER ALLOCATION CONTROL

In an action taken on July 7, WPB revoked Order M-244, transferred allocation control of furnace type carbon black to Order M-300 (Chemicals), and extended allocation controls of the latter order to include the rubber grades of channel type carbon black. At the same time, a revised procedure for the disposal of surplus and excess stocks of acrylic monomer and acrylic resin was issued in an amendment to Order M-300.

In an attempt to assure an adequate supply of furnace type carbon black for the rubber industry, allocation controls were made somewhat tighter under provisions of the order, while the action brings rubber grades of channel type black under allocation for the first time.

In the interests of simplified paper work, customers may now order up to 20,000 pounds of furnace type carbon black or rubber grades of channel type carbon black by filing an end-use certificate with the supplier, who must obtain WPB authorization for such quantities on Form WPB-2947. WPB authorization is required for all quantities over 20,000 pounds.

Prior to the revision, a customer, according to the provisions of M-244, could order a maximum of 5,000 pounds of carbon black, upon the filing of an end-use certificate. The small order exemption remains at 100 pounds with no end-use restriction. Formerly this exemption was restricted to rubber compounding only.

Previously, on June 12, WPB placed acetylene black under allocation for the first time. This black, also brought under Order M-300, is subject to a 25-pound small order exemption. The chief use of acetylene black is in battery dry cells and rubber compounding and new indirect military requirements created an imbalance between supply and demand, leading to allocation control.

Other orders affecting the rubber industry in the past few weeks included the following:

CABLE WRAPPING TAPE

Manufacturers of cable wrapping tape made of GR-S or Butyl rubber who in March, 1942, quoted prices on the basis of weight will be permitted to recompute their maximum prices on a per-yard basis after July 3, OPA announced on June 29. This change in the pricing regulation was covered by Amendment No. 16 to M.P.R. 220 (Certain Rubber Commodities).

In some cases ceiling prices were formerly based on the weight of the material. Natural rubber, however, is heavier than the synthetic types, and since the unit of use is area rather than weight, the new method for arriving at maximum prices is fairer to the manufacturer and does not increase the cost to the consumer above that for the same number of yards of tape made of natural rubber during the base period, OPA said.

An example of how manufacturers will be permitted to convert March, 1942, ceiling prices from a per-pound basis to a square yard basis follows: If during March, 1942, the natural rubber tape sold for 40c per pound and weighed 60 pounds per 100 square yards, the March, 1942, price for a square yard is 40c x 60 divided by 100, or 24c per square yard, which is the maximum price per square yard for cable wrapping tape made with GR-S or Butyl.

SOLES AND HEELS

According to Amendment No. 6 to M.P.R. 477 (Sales of Rubber Heels and Soles in the Shoe Factory and Home Replacement Trades), issued by OPA on June 15, and effective June 20, manufacturers of rubber heels and soles for the shoe factory trade can take the prices of their nearest competitors as ceilings for new products only when the competitors actually sold or offered the same type of heel or sole in the base period. This specific requirement heretofore was merely implied, but has now been written expressly into the section dealing with this method of establishing the maximum price.

Ordinarily, manufacturers use either dollar-and-cents ceilings listed in the regulation governing these heels and soles, or take their base period highest prices. The base period is either March, 1942, or October 1, 1941, to February 28, 1942. When they cannot use these two methods, they take the prices of their nearest competitors. Before a competitor's price can be taken, the competi-

tor must have sold the same type of heel or sole in either of these two base periods and be establishing his ceiling on that basis.

The new amendment will prevent the use of a competitor's price which has been established pursuant to a special application to OPA on the basis of special conditions and circumstances.

BOOTS AND SHOES

Several revisions in the ration regulations affecting rubber footwear establishments that close out or transfer their entire stocks of men's rubber boots and work shoes were announced by OPA on June 28. These revisions, incorporated in Amendment No. 12 to Ration Order 6A (Men's Rubber Boots and Rubber Work Shoes), included the following:

1. When an establishment closes, the owner or his representative is to give the OPA district office, within five days after the closing, the following material: the establishment's certificate of registration; all rubber footwear purchase certificates on hand; all inventory records required by the ration order; a list of any certificates owed to or by the establishment, with the name and address of persons to or from whom they are due; and a statement of the number of pairs of each rationed type of rubber footwear on hand.

2. When the entire stock of a rubber footwear establishment is transferred to a new owner, ration certificates need not be paid if both buyer and seller first report to the OPA district office and obtain approval. Prior approval is necessary for such a transfer, and complete records will be required of both buyer and seller.

3. When an employer who furnishes rationed rubber footwear to his employes closes his business, he may sell any worn rubber footwear he has in stock without getting certificates.

DRUG SUNDRIES

Manufacturers and distributors of rubber bulbs and bulb goods made from neoprene may continue until September 30, 1944, with the present method of determining their ceiling prices for these goods, according to Amendment No. 16 to M.P.R. 300 (Maximum Manufacturers' Prices for Drug Sundries).

Ceilings have been determined on these items by the addition of specified differentials to the maximum prices for natural rubber bulbs and bulb goods, but this method could only be used until June 30, 1944. Now the time limit is extended another three months.

A time limit was placed on the use of this method so that OPA could obtain from industry sufficient cost data for establishing a permanent pricing method for neoprene bulbs and bulb goods. The industry has requested further time in which to present this data. Practically all rubber bulbs and bulb goods, which are used in the drug sundries trade, are now made from neoprene.

MISCELLANEOUS ORDERS

Included among general orders of interest to the rubber industry issued in recent weeks were the following:

Benzol, toluol and xylol, formerly exempt from price control when sold for use in the production of aviation gasoline and synthetic rubber, have been placed under price control at March, 1942, levels, by OPA. Sales of benzol by the Defense Supplies Corp., however, remain exempted. The order does not apply to these three products when they are produced from petroleum.

The terms of Order M-353 have been extended to cover control of zinc sulphide pigments, including lithopone, in addition to titanium pigments. The same regulations with respect to rated orders that formerly applied to titanium pigments only, now apply to lithopone and other zinc sulphide pigments.

NEOPRENE PROCESS MADE AVAILABLE TO SOVIET UNION BY DUPONT

Full technical details necessary for building and operating plants to produce neoprene are being sold to the People's Commissariat of the Rubber Industry of the U.S.S.R. under an agreement dated June 22, 1944, it was announced by E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware, on July 2. The agreement was reached as the result of negotiations undertaken at the request of the United States Government.

Since the United States Government has been granted free rights by DuPont under its patents and processes for military purposes during the period of the war and since the neoprene process is being made available to Russia through negotiation undertaken at the request of the United States Government, no compensation is being asked of the Soviet Union for the production of neoprene while Russia is at war with Germany. The amount of compensation in the post-war period will depend upon the volume of Russian production of neoprene.

The agreement was entered into at the instance of Rubber Director Bradley Dewey in the interest of the war effort. Russia has been receiving large quantities of American neoprene products under Lend-Lease, including belting, hose, and other mechanical rubber goods, and is therefore familiar with the properties of the material.

Complete design drawings, flow sheets, specifications for raw materials and intermediates, and operating control methods are included in the purchase. It is also expected that a number of Russian engineers and industrial supervisors will visit the neoprene plants at Deepwater Point, N. J., and Louisville, Ky., to study the equipment and operating procedures at first hand.

These Russian representatives will have an opportunity to study the original neoprene plant at DuPont's Chambers Works at Deepwater Point, where the know-how was developed that has since been embodied in the new Louisville plant, which was constructed and is being operated for the Government by DuPont. DuPont incorporated in the Louisville plant all the latest developments of the company's thirteen years experience in this field.

The agreement covers the principal type of neoprene, designated by the Government as GR-M and by DuPont as Neoprene Type GN. From this type a large number of neoprene compounds can be formulated to fit a great variety of applications.

The production of neoprene in this country, according to a statement issued by Rubber Director Dewey on June 17, is now fairly consistent at about 13,000 long tons per quarter. The over-all requirements of the armed forces for special articles, such as life rafts, pontoons, pneumatic landing boats, etc., Col. Dewey stated, for which the properties of neoprene are required, approximately balance production.

It was emphasized, however, that the actual manufacture of the military products which call for neoprene fluctuates from time to time, and as neoprene does not store well for any length of time, it may be possible to permit certain varying amounts to be used for other purposes. An excess of approximately 2% of planned production was found to exist recently, and this excess amount was made available during June for the manufacture of other items. This policy will be continued in the future.

Divert Butylene Supply

In accordance with requests for cooperation received from both the Army and Navy departments to maintain the invasion pace set by the United Nations, both in France and in the Pacific, the Office of the Rubber Director announced plans on June 26 for diverting up to 400,000 barrels of butylenes from the synthetic rubber program to the manufacture of 100-octane aviation gasoline.

In making the announcement, Col. Dewey stated that 400,000 barrels of butylenes are equivalent to approximately 30,000 long tons of Buna S. Together with some ethyl benzene to be made available from the styrene plants, they will make about 1,000,000 barrels of high-octane gasoline. The action is a temporary move and will be concluded by September 1.

The Rubber Director pointed out that manpower shortage in the rubber goods manufacturing plants limits our present ability to make tires and other essential

rubber goods, and that the diversion move will not result in the building of one less tire nor the use of one less pound of synthetic rubber.

Prior to the proposed diversion of butylenes to high-octane gasoline, it had been planned to operate the butadiene-from-alcohol plants to make less than 30,000 tons of butadiene per month. In view of the proposed diversion of butylenes, the butadiene-from-alcohol plants will until September be run to make 33,000 tons or more per month.

Thereafter, when the diversion is no longer necessary and the butadiene-from-butylene plants are run at more nearly their rated capacity of 23,000 short tons per month, the butadiene-from-alcohol plants will be run at materially less than 30,000 tons per month.

At the present time, it was said, butadiene-from-alcohol is providing 60% of total butadiene, while butadiene-from-petroleum accounts for the balance. During the July-September, 1944, period, the ration will be 70% from alcohol and 30% from petroleum. After September 1, the ratio is scheduled to be 55% from petroleum and 45% from alcohol.

Butadiene-from-Butylene plants affected by the diversion move include those operated by Cities Service (Lake Charles), Humble Oil (Baytown), Neches Butane Products (Port Neches), Phillips Petroleum (Borger), Shell Chemical (Torrance), Sinclair Refining (Houston) and Standard Oil (Baton Rouge).

Seeks Return of Patents

A suit seeking injunctions to compel the Alien Property Custodian to return securities and patents turned over under protest to that government agent, as reported in our last issue, was filed in the Federal Court in New York City on July 13 by the Standard Oil Co. of New Jersey. The patents were acquired as the result of a transaction in 1929 with I. G. Farbenindustrie, which involved a payment of $35,000,000 in securities to that organization. The Buna S patents were involved in the transaction. Commenting on the action, Eugene Holman, president of Standard Oil, made the following statements:

"The custodian has sought to create the impression that he is seizing enemy property and passing it on free to Americans for their use. Actually, he has confiscated valuable property belonging to American citizens, property in which many American companies have invested huge sums in patent licenses and development work.

"Under our laws, all patents are available for war production. But the custodian, presumably acting under the advice of the Attorney General's office, has arbitrarily adopted a policy of granting free licenses under these patents, not limited to the war but for the full life of the patents—without waiting for court decision on ownership of the patent properties themselves. Instead of holding and conserving such property as custodian, he is dissipating the property and destroying the stimulus to develop it.

"The custodian's excuse for his present policy has been that it would greatly help the war effort. There have been dramatic developments, vital to the nation, of industries based upon patents originating in Germany. But without exception every one of them was sponsored by American concerns who acquired rights under those patents befor the war began. They invested their capital and used their knowledge to develop these enemy-originated ideas to the point where they are now vital factors in the American war program.

"These were results from efforts of American industry, protected and stimulated by the United States patent laws. They were not the results of the mistaken policy of the custodian."

Want Postwar Clarification

As a result of the recent declaration by Attorney General Francis Biddle to the effect that the existing synthetic rubber agreements tend to create a monopoly in that field to the extent "that they provide for patent pooling between various companies and do not require licensing of future applicants," company members of the patent pool agreement are expected to seek clarification of their postwar status. The Attorney General indicated that members of this pool would face antitrust prosecution after the war "if they barred newcomers from participation in the pooling agreements."

The synthetic rubber patent pooling arrangement originated in December, 1941, when Standard Oil of New Jersey and the four leading rubber companies, U. S. Rubber, Firestone, Goodrich and Goodyear, granted the government licenses to use their basic synthetic rubber patents for the full life of those patents. In turn, the government passed on the grantors' licenses to other participants, thus creating a common pool of synthetic rubber knowledge in this country. The licenses covered general synthetic rubber, but not the specialty rubbers produced by participants, such as Buna N.

Last summer the original pool was broadened when the government, through Rubber Reserve Co., arranged with producers to create a pool whereby patent licenses already made available to the government would in turn be made available to companies interested in producing synthetic rubber, providing such companies turned in to the common pool their own patent rights on synthetic rubber. Thus was provided an incentive for rubber producers to make their knowledge available to others during the war, since they in turn would obtain licenses.

While the patent pooling agreement is scheduled to expire six months after the war, the cross-licensing arrangements resulting from the pool will continue throughout the life of the patents. Synthetic rubber patent holders will be free after the war to grant or refuse to grant licenses on their patents as they see fit.

Although it is not yet certain what action, if any, members of the existing patent pool will take, it is believed that they may seek a declaratory judgment in the Federal courts advising whether they will be vulnerable to postwar antitrust action or they may seek to clarify their position by requesting Rubber Reserve to amend or revise the agreements to protect the participants against such postwar action.

INNER TUBES RELEASED FROM RATIONING REGULATIONS AS OF JULY 1

All new inner tubes—passenger car, truck, tractor and implement—were released from the rationing regulations as of July 1, according to an action taken by OPA with the full concurrence of the ORD. The release of tubes from rationing was made possible by field inventories. In announcing the decision, OPA pointed out that the move aids in the conservation of tires, since a good tube properly inflated prolongs the life of a tire. The OPA action was taken by the issuance of Amendment No. 78 to Ration Order 1A (Tires, Tubes, Recapping and Camelback).

Under date of June 30, the ORD announced that the following allocations, including truck and tractor tires, were released to OPA for the month of July: Passenger tires, Grade I, 1,950,000; Truck tires, 7.50 and under, 375,000; Truck tires, 8.25 and up, 135,000; Front tractor and implement tires, 7.50 and under, 55,000; Rear tractor and implement tires, over 7.50, 23,000. At the same time it was announced that the August passenger tire quota has been established at 1,950,000 units.

In announcing the July allocation, the Rubber Director stated that more new passenger car tires are being released than are currently being manufactured, but this was planned during the winter months when an additional reserve was built up in order to care for increased demand during the hot weather months. The truck tire quota, he said, which is in excess of production for civilian use, will probably exhaust the small remaining inventories of both new and used truck tires.

Provide Freight Allowances

Three changes in the regulation governing ceiling prices of original equipment tires and tubes (R.M.P.R. 119) to provide for freight allowances in accordance with customary industry practices were made by OPA on June 21 with the

issuance of Amendment No. 1 to that regulation. The amendment also broadens conditions under which applications for individual adjustment of ceilings may be filed. Inadvertent errors in the dollar-and-cent ceilings for two tires, which were contained in a revision of the regulation that became effective April 18, were also corrected.

All of the changes, which were effective June 26, affect only manufacturers of tires and tubes sold to original equipment makers, and no retail prices are involved. The correct price for a 11.00-20, 14-ply special tread mud-and-snow tire is now stated as $63.60. The flap ceiling is 86 cents, and the tube ceiling is $4.79. The combined ceiling for the assembly is $69.25. The ceiling previously had been incorrectly given as $74.02 for the tires, which with the flap and tube ceilings brought the assembly to $79.67.

Packing Costs May Be Added

When special packing has to be provided for overseas shipments of new tires and tubes sold to a government agency, the extra costs incurred for this special packing can be added to the existing maximum prices for the tires and tubes, OPA announced on July 4.

These additions, which can be made by suppliers, apply to shipments made since June 12, 1944, when it was provided that prices charged could be adjusted upward in accordance with any additional for special packing later granted by OPA. This adjustable pricing provision became inoperative automatically on July 8, the effective date of the new action, covered by Amendment No. 7 to M.P.R. 415 (Certain Federal Government Purchases of New Rubber Tires and Tubes).

The order now permits the addition of (1) the difference between the total cost of standard packing and the total cost of packing to the specifications of the buyer, or (2) if the commodity has already been packed in standard packing and if repacking to the specifications of the buyer is required, the total cost incurred in the unpacking and repacking, less the reasonable value of salvaged materials, or (3) if the commodity has been initially packed to specifications of the buyer that are different from standard packing, and if repacking to new specifications of the buyer is required, the amount already permitted for packing other than standard plus the total cost of unpacking and repacking, less the reasonable value of salvaged materials.

Prices Set for Implement Tires

Maximum wholesale prices of farm implement tires and tubes for sellers other than brand name owners, which will be generally for sales by dealers or jobbers, will be determined on the same basis as ceilings for farm tractor tires and tubes, as of July 5, according to Amendment No. 1 to R.M.P.R. 143 (Wholesale Prices for New Rubber Tires and Tubes), released by OPA on June 30. In both instances, the wholesale ceilings will be established by deducting a minimum discount of 25% from the maximum retail prices.

In a revision of the wholesale regulation, which became effective on May 1, 1944, the discounts had been 30 per cent for farm implement tires, 35 per cent for farm implement tubes, and 25 per cent for farm tractor tires and tubes. Farm implement tires and tubes are now put on the same basis as farm tractor tires and tubes for the reason that they have always been treated as one group by the industry.

The May 1, 1944, revision of the wholesale new rubber tire and tube regulation provided that a dealer who had legally established discounts under the previous Maximum Price Regulation 143, that were lower than the minimum discounts fixed by the revised regulation, could continue to use the lower discounts if he filed a report with the appropriate OPA district office on or before May 15, 1944.

In another action—Amendment No. 1 to Order No. 14 to R.M.P.R. 143—twelve additions to the list of imported new natural rubber tires and tubes were made. These additions, effective June 28, cover eight passenger car tires, two truck tires, and two passenger car tubes.

Additional Tractor Tire Ceilings

Retail ceiling prices for three additional sizes of farm tractor tires, effective June 27, were set by OPA with the issuance of Order No. 5 under M.P.R. 528 (Tires and Tubes, Recapping and Repairing). They are $52.85 for a 9-24, 10-ply rear tire; $35.00 for a 7.50-10, 8-ply front tire; and $9.55 for a 4.00-12, 4-ply front tire. Firestone recently added these three new sizes to its list of farm tractor tires, but the ceilings established will, of course, apply to sales of these sizes by any company, at retail.

Revise Rubber Order R-1

The expected revised rubber regulation, officially known as Rubber Order R-1, as Amended July 1, 1944, has made its appearance. Although the new order contains certain changes for various products, it does not change established policy to any extent. It permits the use of GR-S in any quantity to manufacture any product for the Army, Navy or Maritime Commission, and expands the use of neoprene in mechanical goods. The revised order also incorporates granted appeals to manufacture specific items, thus bringing it more up-to-date. A complete report on the revision will be made in the next issue.

Guayule Project Extended

Despite continued insistence from a small group of congressmen that the guayule rubber project be liquidated, the House of Representatives voted on June 20 by 299 to 43 to maintain the project for at least another year. The action assures an appropriation of $3,020,985, and covers further research, construction of a new processing mill near Bakersfield, Calif., and continued cultivation. Representatives Anderson (Calif.) and Poage (Texas) led the fight for continuation of the project, with major opposition coming from Representatives Tarver (Georgia) and Cannon (Missouri). As chairman of a special committee which investigated the project for the House, Representative Poage expressed faith that guayule can compete successfully with both imported crude rubber and domestic synthetic rubber.

Tritons Used in Rubber Field

Triton NE and Triton N-100, designed primarily for use in the textile trade as wetting agents and detergents, are reported to be finding vital wartime uses in the manufacture of rubber life rafts and mine trap covers, as well as in priming compounds, electro-plating and pickling baths. Developed by the Rohm & Haas Co., of Philadelphia, the chemical and physical properties of these Tritons make them compatible with almost any type material. NE emulsifies oils and hydrocarbons while N-100 is also soluble in most organic compounds excepting aliphatic hydrocarbons.

Fosterite—New Coating Material

Fosterite, described as a tough, moisture-proof plastic, which has replaced rubber in many applications, was recently announced by the Westinghouse Electric & Manufacturing Co. At present, it is being used exclusively in the coating of parts used in radar and communications equipment for the Armed Forces. In its initial, unfused state Fosterite flows like water and completely floods every opening or recess in a coil, transformer or other component. It requires no liquid solvent to make and fuses into an impenetrable solid when heated.

The name "Clad" has been given to the line of protective skin creams recently developed and introduced by Goodrich. It is made in two types—for dry and for wet working conditions.

Goodyear has revealed that its steel cable belts are now being used between the power units and rear wheels of a 150-pound motorcycle being made for the Army and Navy by the Simplex Manufacturing Co., of New Orleans, La.

PILOT PLANT AND LABORATORY FORMALLY DEDICATED AT AKRON

The pilot plant and laboratory constructed in Akron by the Rubber Reserve Co., and which is being operated for the government by the University of Akron under special agreement, was formally dedicated on June 28. Participating in the dedication ceremonies were Rubber Director Bradley Dewey, Dr. H. I. Simmons, president of Akron University, Dr. E. R. Gilliland, Assistant Rubber Director in Charge of Research and Development, and Stanley T. Crossland, vice-president of the Rubber Reserve Co.

In making the dedication address, Col. Dewey stated that the nation's scientists are determined to produce a better synthetic rubber "than any tree rubber ever produced" and predicted that before the new pilot plant and laboratory reach their first birthday "we will have a far better understanding of synthetic rubber." Dr. Simmons said that Akron took great pride in the fact that the laboratory and plant have been located in that city and added that "our people will encourage and support the work we are doing here in search of better ways of making synthetic rubber." The dedication was closed with the raising of the flag over the government property while "To the Colors" was played.

The laboratory and pilot plant are located on West Wilbeth Road, near the government-owned copolymer plant operated by Firestone. The laboratory is a two-story structure, with 8 rooms on the first and 11 rooms on the second floor. The compounding, milling and curing sections are on the first floor, with the chemical testing, physical testing, abrading and aging rooms upstairs.

Equipment already installed in the laboratory includes 3 Farrell two-roll mills, 6 Stewart Bolling presses, a No. ½ Royle extruder, 2 Mooney plastometers, a Banbury mixer, several Precision Scientific ovens, Bierer-Davis oxygen bombs, four air bombs, 3 Scott tensile testers, Precision-Bashore resiliometer, Goodyear rebound tester, DeMattia testing machine (National Rubber), DeKhotinsky constant temperature apparatus (Central Scientific), Williams abrader (Scott) and Bureau of Standards abrader (American Instrument), U.S.M.C. gearless sole cutting machine, Tag recorders, and Scott T-50 apparatus. Additional equipment will be installed in the near future.

The pilot plant has two complete systems—an 80 and 500-gallon system. Its construction follows the standard system installed at most of the government-owned copolymer plants, and the two systems are interchangeable. The pilot plant has been in partial operation for the past several weeks and is expected to be in full operation shortly.

James A. Schade, formerly director of research of the B. F. Goodrich Co., is manager of both the pilot plant and laboratory, responsible to Dr. Simmons. William K. Taft is in charge of pilot plant operations, assisted by D. F. Ryder, W. F. Orr, and V. C. Karl as superintendents. Physical testing in the laboratory is in charge of B. G. Labbe, who was associated with Firestone for approximately 15 years. The plant is largely manned by C.W.S. officers at present.

Rubber Plate Separators

A microporous, wafer-thin rubber is now replacing wood in the manufacture of storage batteries, according to the U.S. Rubber Co. Its use as a plate separator is said to make possible for the first time the shipment of these batteries to all battlefronts in a fully charged condition but without the acid and water heretofore necessary to insure the electrical charge as well as the life of the battery. The rubber material has millions of tiny cells per square inch and unlike wood it will not buckle should the protecting acid and water mixture become low or completely expended. The rubber separators will outlast wood separators at the ratio of 5 to 1, in acid strength of 1.25 specific gravity.

Plan for Chemical Exposition

According to its sponsor, the Chicago Section of the American Chemical Society, the 3rd National Chemical Exposition, to be held November 15-19 at the Coliseum in Chicago, will not only stress the importance of the chemical industry in the war effort but will reveal much that is planned for the postwar era. Space at the exposition is reported to already be about gone. An important feature of the show again this year will be the National Industrial Chemical Conference and noted authorities on virtually all phases of pure and applied chemistry will appear on the program. Headquarters for the exposition are maintained at 330 South Wells St., Chicago.

Goodyear Seeks Dirigible Routes

Renewed interest in lighter-than-air transport in the postwar period is indicated in the report that the Goodyear Aircraft Co. has made application to the Civil Aeronautics Board for international air transport routes using dirigibles. The U. S. Airship Co. recently made a similar application for trans-Pacific routes. Interest in lighter-than-air transport is also said to have been shown in recent months by foreign shipping organizations.

WAFER-THIN RUBBER BATTERY SEPARATORS BEING MADE BY U. S. RUBBER

There are four major steps in the manufacture of the wafer-thin battery separators which are being made at the Providence, R. I., plant of the U. S. Rubber Co., and which have been reported to be far superior to the wooden types normally used. The final step in the process is shown in the above illustration. In this step, hot water is poured on the material to insure the removal of any or all foreign matter. It is then cut in the required size where it is automatically fed to the drying machine in the upper right.

DEDICATION OF NEW MIDWEST RUBBER RECLAIMING LABORATORY INCLUDES AN INTERESTING TECHNICAL PROGRAM AND DISCUSSION

Formal dedication of the new laboratory of the Midwest Rubber Reclaiming Co., built adjacent to the company's reclaiming plant at East St. Louis, Ill., was made on June 27. The dedication was made by Rubber Director Bradley Dewey, with a few brief remarks by William Welch, president of the company. In addition to the formalities, the dedication was marked by a tour of both the company's reclaiming plant, as well as the laboratory, and a technical program. Approximately 120 invited guests participated in the activities.

The program started early on the morning of June 27. After registering at various hotels in St. Louis, the guests were taken by bus to the site of the company's plant in East St. Louis, where they proceeded to inspect both the plant and the new laboratory. For the edification of those present, both GR-S and neoprene reclaim was run in the plant, although it was emphasized that these runs were not regular production runs as yet. Midwest Rubber Reclaiming, however, is prepared to furnish synthetic reclaim as soon as sufficient demand is apparent.

Description of Laboratory

The laboratory is housed in a fireproof building of brick and concrete construction, consisting of 10 rooms. These include four offices, chemical laboratory, physical testing laboratory, mill and press room, constant temperature and humidity test room, autoclave and high pressure steam room, bomb aging room, and storage and rest rooms. The equipment, all of which was not yet installed at the time of the dedication, will include laboratory mills, refiners and presses, tubing machine, tensile testers, abrasion and flexing machines, plastometer, and all of the necessary auxiliary equipment for the complete physical and chemical testing of natural and synthetic rubber.

Dedication of Laboratory

Following the inspection tours, formal dedication of the new laboratory was made. Before introducing Col. Dewey, Mr. Welch first made mention of the fact that Midwest Rubber had progressed steadily in its first 16 years of existence and that the new laboratory was "a monument to faith." He revealed that as part of the dedication ceremonies, a lead cylinder would be buried in front of the laboratory, containing motion pictures of the ceremonies and other records attendant on the dedication, this cylinder to be opened in fifty years. He also paid special tribute to the company's board of directors, all of whom were present with one exception, and introduced each of them in turn. He then introduced the Rubber Director.

In acknowledging the introduction, Col. Dewey first referred to the fact that the officers of Midwest Rubber had sufficient foresight several years ago to recognize that some day the reclaiming of synthetic rubber might prove essential. For this reason they established a special project at the Massachusetts Institute of Technology about four years ago, the results of which are now evident. He also paid special tribute to the leadership of Mr. Welch, and then unveiled a plaque. The plaque refers to the burial of the lead cylinder and lists all of the current officers and directors of the Midwest company.

After the formal dedication, the guests were taken by bus to the Hotel Statler in St. Louis to attend a luncheon of the St. Louis Chamber of Commerce, at which Col. Dewey was the principal speaker. In this talk, the Rubber Director traced the development of the government over-all synthetic rubber program, by means of numerous slides, making terse comments on each of the slides as shown. In concluding his address, he emphasized the fact that the synthetic rubber passenger tire of today is equal to if not superior to the natural rubber tire of yesterday.

Technical Papers Presented

Following the luncheon, a two-hour technical program was held at the Hotel Coronado in St. Louis, with Dr. E. A. Hauser, associate professor of chemical engineering of M.I.T., presiding. Dr. Hauser is in charge of the Midwest reclaiming project at M.I.T. The program consisted of two papers, one on "Some New Insights into the Structure of Rubber," by Dr. D. S. le Beau, research associate of the Department of Chemical Engineering of M.I.T., and the other on "GR-S Reclaimed Rubber—A New Compounding Material," by Robert Randall, chief chemist of Midwest Rubber Reclaiming.

In discussing the structure of rubber, Dr. le Beau stated that a historical review of the development regarding the chemistry and molecular structure of rubber since Faraday obtained a low boiling liquid by dry distillation of the "elastic resin" in 1821 clearly demonstrates the complexity of the problem. She discussed the first attempts to polymerize isoprene, its substitution with more readily available diolefines like butadiene, the significance of the results obtained by micro-dissection of individual rubber particles in latex in regard to differences in degree of polymerization of the hydrocarbon, the effect of solvents on various types of natural and synthetic rubbers, and the differences in the amount of soluble fractions—all from the standpoint of comparison of the physical properties.

Dr. le Beau then discussed the results of X-ray diffraction studies and the latest contribution in the constant study of the ultimate structure of rub-

LEFT: Rubber Director Bradley Dewey reading the inscription on the plaque at the dedication of the new laboratory of the Midwest Rubber Reclaiming Co., at East St. Louis, Mo. CENTER: Some of the guests in front of the new laboratory. RIGHT: William Welch, Midwest president, before the microphone during the dedication ceremonies.

ber—the results obtained with the electron microscope. Numerous slides were used to illustrate these results. (EDITOR'S NOTE: For a detailed discussion of the technique used in making electro-micrographs and for their reproduction, it is suggested that the reader see the article on this subject by Messrs. Hall, Hauser, le Beau, Schmitt and Talalay, which appears in the July, 1944, issue of *Industrial & Engineering Chemistry.)*

These most recent results visually demonstrate that rubber is not homogenous but consists of at least two phases, one liquid, the other solid; they show the drastic changes the former undergoes during vulcanization and they offer some interesting insight into the phenomenon of reinforcement with carbon black. Differences in the physical structure of rubbers, which chemically are identical, were clearly shown.

An outlook in the future, said the speaker, permits the assumption that a combination of some of the oldest and most recent results of our studies regarding the structure of rubber and the application of as varied approaches as possible will eventually give us the final answer, including the question what vulcanization actually is and what happens during the process of reclaiming.

Randall Discusses GR-S Reclaim

In his paper on "GR-S Reclaimed Rubber," Mr. Randall compared GR-S tire reclaim, as produced by Midwest Rubber Reclaiming, with conventional natural rubber reclaims in a number of formulations, including Grade C and F camelback, S-3 type tire carcass, military heels and soles, hard rubber, high quality matting and jar rings. In all cases, he stated, the GR-S reclaim compared favorably with the natural rubber reclaim.

The tests on which the talk was based indicated, according to the speaker, that GR-S reclaim is slightly inferior to the natural rubber product in its tear resistance, slower rate of cure and lack of tack. These faults, he said, may be corrected by proper compounding, and it is to be expected that with further research a synthetic reclaim can be produced which will be equal to or better than the natural rubber reclaim.

In addition to the two technical papers presented, both of which drew considerable discussion from the floor, Col. Dewey made a brief appearance at the beginning of the program and agreed to answer any questions on the rubber situation. Several such questions were asked, and all of them brought a straightforward reply.

Following the technical program, all of those present were the guests of Midwest Rubber Reclaiming at a cocktail party and later at dinner. In the evening, the guests were taken to the famous St. Louis Municipal Outdoor Opera in Forest Park where they saw and heard the operetta "Eileen."

Coming Events

July 22. Chicago Rubber Group, Outing, Lincolnshire Country Club, Steger, Ill.

Aug. 6. Northern California Rubber Group, Outing, Camp Caves, Tilden Park, Berkeley, Calif.

Sept. 11-15. 108th Meeting, American Chemical Society, New York, N. Y.

Oct. 3-5. 33rd National Safety Congress & Exposition, Hotels Sherman, Morrison and LaSalle, Chicago, Ill.

Nov. 15-19. Third National Chemical Exposition, Coliseum, Chicago, Ill.

ASME RUBBER-PLASTIC GROUP HAS MEETING IN PITTSBURGH

Two interesting sessions were held by the Rubber and Plastics Division of the American Society of Mechanical Engineers at the William Penn Hotel in Pittsburgh, Penna., on June 22, held in conjunction with the semi-annual meeting of the parent society. Five papers in all were presented at the sessions, which attracted approximately 60 members and guests.

Two papers were presented at the morning session, held jointly with the Aviation Division of the society. In discussing "The Effect of High Relative Humidities in Producing Changes in Dimension of Plastics," the first paper, A. C. Titus, of the General Electric Co., Schenectady, N. Y., said that dimensional changes due to moisture absorption in laminated plastic products are closely related to the type of filler employed, with the dimensional changes being related to changes of relative humidity. The specific effects of fillers were outlined.

"Use of Rubber and Synthetics for Sealing Aviation Fuel System Equipment" was then discussed by T. R. Thoren, of Thompson Products, Inc., Cleveland, during which the speaker analyzed the requirements of synthetic rubber seals for fuel booster pumps, selector cocks, and engine-driven pumps, developments with which he has been personally connected. He stated that the best physical form of a synthetic rubber part to meet the specific requirements is arrived at by making provisions in the design for the limitations of the rubber stocks available.

Three papers formed the afternoon session, one on rubber and two on plastics. E. G. Kimmich, of the Goodyear Tire & Rubber Co., Akron, talked on "Mechanical Rubber Goods as Used on Modern Aircraft," in which he covered the wide range of molded rubber products currently used in airplane construction.

The papers on plastics included "Effect of Some Environmental Conditions on the Mechanical Properties of Cellulose Acetate and Cellulose Nitrate Plastic Sheets," by T. S. Lawton, Jr., T. S. Carswell and H. K. Nason, of the Monsanto Chemical Co., Springfield, Mass., which was delivered by Mr. Nason, and "Hot-Forming of Phenolic Laminates," by H. C. Guhl, of the Westinghouse Electric & Manufacturing Co., Trafford, Penna.

Mr. Nason showed in detail the effect of ambient temperature, relative humidity, testing speed and sheet thickness on the tensile properties, and of temperature on the compressive, flexural, shear and impact properties of cellulose acetate and cellulose nitrate plastic sheets. The general nature of these effects was summarized. Mr. Guhl discussed the hot-forming of phenolic laminates in general, particularly from the angles of heat distortion and hardness. He showed a flow chart of the laminating process, and exhibited numerous samples, both large and small.

J. R. Booth, of Thompson Products, Inc., Detroit, Mich., acted as chairman of the morning session, while E. Gray King, of the Mellon Institute, Pittsburgh, Penna., acted in a similar capacity for the afternoon session. At the end of the second session, a vote of thanks was extended to the local committee in charge of arrangements for a job well done.

Collapsible Rubber Contour Maps

Collapsible rubber contour maps of enemy coastlines, made for the Navy by a process developed by the U. S. Rubber Co., have assisted in planning recent landing operations and in reducing casualties among the invasion forces, according to a statement issued by the company. The most recent use of these maps was in the invasion of Northern France.

In the manufacture of the rubber maps, information is gathered from all possible sources and brought up to date by aerial photography. From this data a model is built showing the coastline rising to mountains with all existing buildings and construction as well as natural landmarks.

From the model a plaster negative is cast, with mountains showing as depressions. On this negative model, according to the method developed by U.S. Rubber, natural rubber latex is sprayed and dried. After reinforcements to prevent the thin layer of rubber from collapsing in its mountainous areas, the model is cured, stripped from the mold, colored to simulate the actual landscape, and the result is a contour map or model of an invasion coast which may be rolled up and transported by plane or landing boats and studied by invasion forces right up to the time of actual landing.

NEED FOR NATURAL RUBBER IS EMPHASIZED BY COLLYER

The intensified military campaign against Japanese-held areas in the Pacific emphasizes the necessity of obtaining as much desperately-needed natural rubber as possible, and with utmost speed, when rubber areas begin to come under Allied control, John L. Collyer, president of the B. F. Goodrich Co., Akron, stated in Washington, D. C., on June 29.

It is of first importance to expedite receipts in this country of tree rubber —still vitally needed for combining with the now relatively plentiful synthetic—as plantation areas are recaptured, Mr. Collyer said. Equally important, he pointed out, is "the need for sound policies to deal with the economic and political problems the gradual 'return of rubber' will raise."

Stressing the probability that it will be at least two years after the first recapture of Far East rubber-producing territories before normal operations can be restored, Mr. Collyer gave a three-point outline of policy questions affecting this period. His outline took into account the probable economic effect of the huge synthetic rubber producing establishment that has been created in this country, and dealt with: allocation (of both natural and synthetic); centralized governmental purchasing, and controls over specifications (as to ratios of synthetic and natural) for manufactured articles.

(1) As to allocation, he pointed out that during the war period allocation of rubber to the United Nations has been a function of the Combined Raw Materials Board, and said that, 'upon re-occupation, this board should continue to allocate both natural and synthetic rubber."

(2) Mr. Collyer felt no change need be made "for the duration" in the present system of centralized purchase of natural rubber by each nation, and allocation to its rubber products makers; and

(3) As to specifications, he said that although the increasing supply of natural rubber (in the period after the start of recapture of Far East territories) will tend to remove the necessity for wartime controls over ratios of natural, synthetic, reclaim and other elements in manufactured products, "it may be desirable that the natural rubber content of finished products continue to be fixed for awhile. But controls can be progressively eased and, as soon as possible, should be removed altogether."

Goodyear has established a tire repair and retreading plant in Caracas, Venezuela. The plant is the third of its kind to be put into operation by the company in South America and the fifth to be established on foreign soil. The others are in Colombia, Peru, South Africa and Mexico.

Rubber in Super Bombers

Nearly two tons of synthetic rubber are required to make the thirty bullet-sealing fuel tanks of the Boeing B-29's, the new super bombers of the American Air Force, according to engineers of the U.S. Rubber Co. Although the total weight of rubber in this plane is close to 5,000 pounds, the tires and tubes have been redesigned and are the lightest per pound of load in any plane. The six tires and tubes in the tri-cycle landing gear formation weigh only 1,288 pounds and contain less than 600 pounds of rubber. In all, more than 200 rubber items enter into the construction of each of the giant bombers.

New Tackifier and Extender

Pentacizer 344, a new tackifier and extender for synthetic rubber, has been commercially introduced by the Heyden Chemical Corp., 393 Seventh Ave., New York 1, N. Y. The new material is a brown, resinous, friable solid, which is soluble in ketones, aromatic hydrocarbons, vegetable oils, mineral oils and the synthetic rubbers. Investigations are said to have indicated that the use of up to 40% of Pentacizer 344 will soften and tackify the synthetics, especially GR-S, and that the tack will remain to a considerable extent after vulcanization. When less than 25% of the material is used, the uncured stock possesses considerable tack, but the cured rubber is not sticky and maintains good nerve.

California Outing on August 6

The Second Annual Summer Outing of the Northern California Rubber Group is scheduled to be held on Sunday, August 6, at Camp Caves, Tilden Park, Berkeley, Calif. The cost has been set at only $1.00 per member or guest and 50c for children under ten. Features of the outing will include a golf tournament, soft ball game, swimming contest, dart contest, guessing game and treasure hunt. Members and guests are requested to bring their own lunch, but dessert will be provided by the group. Reservations for the outing should be made with Don Good, c/o American Rubber Co., Emeryville, Calif.

Inner tubes of Butyl Rubber have been put into mass production at U. S. Rubber's Indianapolis plant. These tubes, for the time being, will be used for military tires.

PROGRAM SET FOR MEETING OF RUBBER SAFETY GROUP

The program for the meeting of the Rubber Section of the National Safety Council which will be held at the Hotel Morrison in Chicago on October 3 and 4, in conjunction with the 33rd National Safety Congress and Exposition, has been virtually completed.

The section's meeting will feature two symposiums, and will include a report of sectional activities by the General Chairman, Paul Van Cleef (Van Cleef Bros.), and election of officers for the 1944-45 season. Awards in the 1943-44 safety contest will also be made, with Roland Kastell, of U. S. Rubber, discussing outstanding facts, and J. I. Banash, consulting engineer of Chicago and past president of the National Safety Council, making the presentations.

The first symposium—Safety in Processing Synthetics—will be presented on Tuesday afternoon, October 3, and will feature three papers as follows: *Dermatitis in the Manufacture and Use of Synthetic Rubber,* by Louis Schwartz, U. S. Public Health Service, Bethesda, Maryland; *Accident Control,* by Glen D. Cross, Firestone Tire & Rubber Co., Akron, Ohio; and *Fire Control,* by Henry C. Jones, Arkwright Mutual Fire Insurance Co., Boston, Mass. General discussion will be led by Thomas H. Boyd of the Manhattan Rubber Manufacturing Division of Raybestos-Manhattan, Inc., Passaic, N. J.

The second symposium—Safety Problems Created by the Limited Labor Supply in the Rubber Industry—will be presented on Wednesday morning, October 4, and will also include three papers: *Psychology—An Aid to the Foreman,* by Dr. Harold C. Taylor, Western Electric Co., Cicero, Ill.; *How to Safely Use the Handicapped War Veteran,* by Dr. George Hostetler, Hines Hospital, Chicago, Ill.; and *Experience Gained in the Handling of Handicapped Individuals,* by a speaker to be selected. General discussion will follow this symposium as well.

The report of sectional activities by the general chairman will open the two-day meeting on the afternoon of October 3, while the election of officers and presentation of awards in the 1943-44 safety contest will take place on the morning of October 4. Roland Kastell, of the U. S. Rubber Co., 1230 Sixth Ave., New York 20, N. Y., is secretary of the Rubber Section, N. S. C.

The Rubber Manufacturers Association, 444 Madison Ave., New York City, is issuing a series of six releases covering ways in which to prolong tire life. The releases are being furnished to newspapers, magazines, house organs, etc.

Goodyear recently announced that it has already produced its 1,500,000th, 6.00 x 16, synthetic rubber passenger tire.

ASTM'S 47th ANNUAL MEETING OUTSTANDING IN MANY RESPECTS

The 47th Annual Meeting of the American Society for Testing Materials, held at the Waldorf-Astoria Hotel in New York City on June 26 to 30, was outstanding in several respects. These included a record-breaking registration of 2,063 members and guests, 16 formal technical sessions with several informal round tables, more than 250 meetings of technical committees, and a large number of actions on specifications and tests for materials, including over 50 new standards.

Features of the meeting included the 19th Marburg Lecture on "Textile Fibers—An Engineering Approach to an Understanding of Their Properties and Utilization," by Dr. Harold DeWitt Smith; a guest address on "Minerals in War and Peace" by Dr. Charles K. Leith; and a Symposium on Analytical Colorimetry and Photometry in which some 15 authorities discussed apparatus and equipment available and the applications of various methods in different fields.

Election of officers at the meeting resulted in the selection of P. H. Bates, chief of the Clay and Silicate Products Division of the National Bureau of Standards, as president, and Arthur W. Carpenter, manager of testing laboratories of the B. F. Goodrich Co., as vice-president. Five new members of the Executive Committee were also elected.

Two new tentative standards of important significance in the war emergency were approved by the A.S.T.M. as developed by Committee D-11 on Rubber Products, one giving specifications for cellular rubber products formulated by a special committee organized under the Army Ordnance auspices. The material covered is of two types grouped into four classifications including sponge, latex, foam, and expanded rubbers. The various test methods are covered in a previously issued Method of Testing Sponge Rubber Products (D-552 — 43 T) in which a number of revisions were accepted at the meeting.

Because of the inadequacy of the brittleness test which was a part of a standard previously approved (D-736), intensive work has resulted in a new test for stiffening of vulcanized elastomers at low temperatures. Young's modulus in bending is determined at low temperatures and used as a measure of the cold-stiffening characteristics of the material. Provision is made in the method for measuring the stiffening effect produced either by crystallization or by second order transition (vitrification) whichever is involved in the material being tested.

RUBBER AGE will pay 50c for each copy of its February, 1944, issue returned.

Cable Companies Again Sued

Civil suits against nine cable companies and six individuals were filed in Federal Court in New York City by the Department of Justice on June 17. The defendants are charged with submitting collusive bids to the Government in the sale of patented cable used in the construction of ships for the Navy. The civil suits grew out of an action brought in 1942 in which the corporate defendants paid $77,500 to the government and were brought at this time to forestall an informer suit brought against the same defendants. Companies involved in the action, which seeks to recover $2,000 for each sale based on alleged collusive bidding, include Rockbestos Products, General Electric, Okonite, Collyer Insulated Wire, Phelps Dodge, American Steel & Wire, General Cable, Anaconda Wire, and National Electric Products.

The natural and synthetic resin business of the Strook & Wittenberg Division of U. S. Industrial Chemicals, Inc., is now an integral part of U.S.I.'s operations and is being conducted under the name of U. S. Industrial Chemicals, Inc. The resin personnel and agents remain the same.

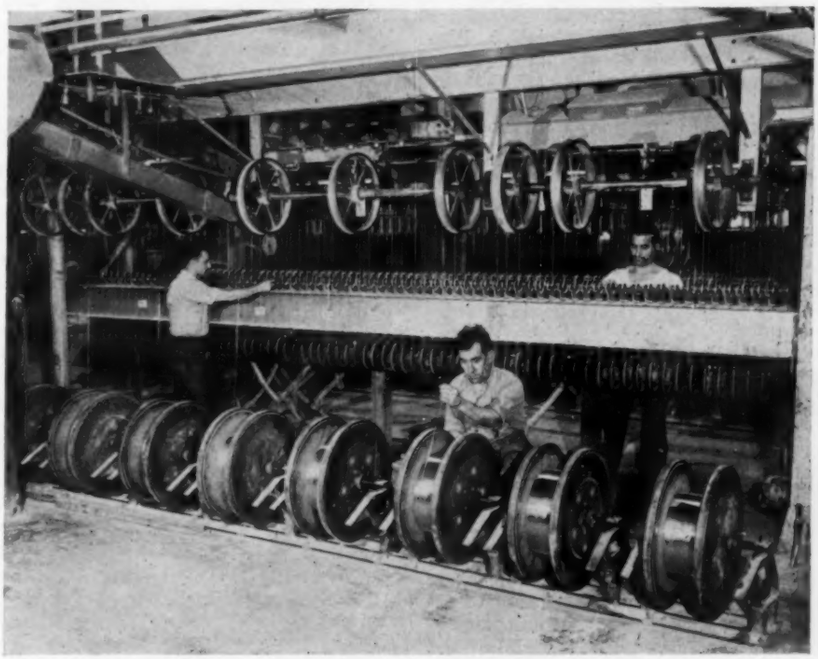
Offer Coumarone Emulsion

Nevilloid C-55, a water soluble, coumarone-indene resin emulsion, believed to be the first such emulsion offered commercially, has been introduced by the Neville Co., Pittsburgh, Penna. The new product will stand dilution with water and exhibits resistance to break by freezing. It possesses valuable properties for use with latex and can be incorporated with latices of natural rubber, GR-S or Hycar OR without prior dilution or without causing coagulation of the rubber by the addition of a 10% aqueous sodium hydroxide solution only, in an amount sufficient to give a pH of 10. Nevilloid C-55 blends with alkyd resin emulsion of various types without pretreatment. It is also usable with emulsions of paraffin wax, carnauba wax and Hydrowax.

Chicago To Issue Year Book

The Executive Committee of the Chicago Rubber Group has decided to put out a Year Book for 1945. This will be the second group to issue such an annual, the Los Angeles Rubber Group having initiated the idea two years ago. A complete roster of members will be included in the Chicago book.

LATEX TOWER AIDS IN MANUFACTURE OF QUANTITIES OF INSULATED WIRE



Billions of feet of insulated wire are currently being manufactured for the Armed Forces. The above illustration shows the lower portion of a rubber latex tower used at the Bristol, R. I., plant of the U. S. Rubber Co. where huge quantities of the wire are turned out daily. This newly-developed process, it is reported, makes possible the insulating of wire with liquid latex coagulating and drying in one operation. Each tower must be manned with three men to insure proper operation.

Plant Expansion Continues

Rubber manufacturers in the tire and other branches of the industry continue to expand production facilities to meet the increasing demand for all types of rubber products. Plans for the immediate construction of a $2,350,000 plant for the production of soles and heels have been announced by the Endicott Johnson Corp., Johnson City, N. Y. The Defense Plant Corporation will pay the cost of construction, equipment and installation and will retain title to the plant. DPC has also announced a $175,000 contract with the Sun Rubber Co., Barberton, Ohio, to provide machinery and equipment for a new plant. Ohio Rubber Co., Willoughby, Ohio, has leased a property in Conneautville, Penna., for the purpose of expanding its war work, while a comprehensive program of construction that will provide a total of more than 35,000 square feet of additional tire production space and make available enlarged and improved facilities for factory and general offices and research laboratories has been put under way at the Barberton, Ohio, plant of the Seiberling Rubber Co.

Calco Creates Pigment Department

The formation of the Pigment Department, Calco Chemical Division, American Cyanamid Co., was recently announced. The new department will handle all products formerly sold by Calco and the United Color & Pigment Department to the pigment-consuming industries. Included will be Unitane (titanium dioxide) and other products of the Virginia Chemical Corp., the manufacturing facilities of which were recently acquired by Calco from the Interchemical Corp. The Pigment Department will be under the management of John Allegaert, with Leo Sklarz as manager of sales. Dr. R. A. Shive has been appointed director of technical services of the department.

Synthetic-Coated Cloth Targets

Glass cloth boresight targets are being used in theaters of operations to help crews of B-25 Mitchell bombers maintain accuracy of gun-fire and bombing. The targets are actually made of cloth woven of glass fibers and coated with synthetic rubber. Selection of this type cloth was made because of its dimensional stability and because it is resistant to rot and attack of fungus growth. Before leaving on a mission, gun and bomb bay sights are lined up with markings on the target, approximately 60 feet away, for the purpose of determining the proper fire pattern. The targets are about 10½ feet high and 7½ feet wide.

Offer Rubber Boats

Department stores in several cities are offering collapsible rubber boats. These are Navy rejects but are said not to be impaired insofar as performance, serviceability or safety is concerned. Macy's, New York's large department store, recently offered 1-man size boats at $39.95, 2-man size at $49.95, and 5-man size at $69.95. Approximately 100 of these boats stocked in the New York store were sold the first day they were offered.

Accused of Titanium Monopoly

A complaint against E. I. du Pont de Nemours & Co., the National Lead Co., and its subsidiary, the Titan Co., Inc., in which the three companies were accused of having established a monopoly in the titanium industry through a series of agreements, was filed on June 24 by U. S. Attorney General Francis Biddle in the U. S. District Court in New York City. The suit seeks to enjoin the companies from continuing the alleged monopoly and requests compulsory royalty-free licensing of the patents involved. The three companies were accused by a Federal Grand Jury in June, 1943, of creating a world-wide cartel in titanium through an agreement with German, British, Italian, Japanese and other foreign chemical companies. This cartel, it was charged, was created about twenty years ago.

New Duck Coating Developed

Plas-Tex, a new plastic which uses cotton duck as a base and which is intended to replace leather, rawhide, fiber and hard rubber as reinforcing materials for weaving loom replacement parts, such as binders, sweepsticks and other attachments for the picking motions of looms, has been developed and introduced by the E. H. Jacobs Mfg. Co., of Charlotte, N. C., and Danielson, Conn. Development work on the new material was carried out over a two-year period at the rubber and plastics plant maintained by the company at Danielson. The life of loom material made with Plas-Tex is said to be several times that of the materials it replaces.

The fourth in a series of five booklets on post-war planning has been made available by the National Association of Manufacturers, 14 West 49th St., New York 20, N. Y. It is entitled "Guide to Cost Study in Corporation Postwar Planning."

New Engine Mounting for Planes

A new rubber mounting for the engines of the Flying Fortresses has been developed by the Goodyear Tire & Rubber Co., Akron, based largely on work carried out over a two-year period in the physics section of the Goodyear Research Laboratory. The Flying Fortresses make use of radial engines and in general such engines are supported at the rear by a tubular ring known as the mounting ring. A number of the new Goodyear mounts are used to attach the engine to this mounting ring. Each mount consists of two main parts. There is a collar, lined with a rubber bushing, which is attached to lugs welded to the rings. The collar has a socket which is at right angles to the collar itself. The other half of the mounting, a small unit attached to the engine, ends in a ball which fits into the socket. Vibrations developing in the engine are isolated by two features of the new mounting—the ball and socket joint described and the rubber bushing in the collar. The ball and socket, as used, produces a unique rocking motion in the rubber bushing.

Herron Introduces Antisol

Antisol, a new wax for imparting improved resistance in synthetic rubber compounds to atmospheric cracking, has been introduced by Herron Bros. & Meyer. The material is said to be equally effective in all types of synthetic rubbers and dosages of 2 to 4%, based on the rubber hydrocarbon, are recommended. Antisol is reported to be easy to handle and to flux well in rubber. It is much more miscible in Buna N-type synthetics than paraffin. Herron Bros. & Meyer maintain offices at 82 Beaver St., New York City, and 516 Ohio Building, Akron, Ohio.

Improve Reclaiming Process

A new process that greatly improves reclaimed rubber, resulting in a product which shows a decided improvement over other types of reclaim, has been announced by the Firestone Tire & Rubber Co. Paul D. Bowers, of the company's Memphis, Tenn., plant, developed the new process, which is called "flash devulcanization," by which the scrap is exposed to steam at very high pressure. The shortened devulcanization time is said to preserve inherent qualities and consequently to produce a reclaim with high tensile strength and resistance to abrasion.

A "Rayon Glossary," designed to provide a broader and more accurate knowledge of rayon fabrics and terms used in connection with rayon in general, has been made available by the American Viscose Corp., New York City.

TIRE VULCANIZING DEVICE USES ELECTRONIC PRINCIPLES

Development of a tire vulcanizing device employing electronic principles, which enables major tire repairs to be made in 10 minutes in combat zones and which gives some hope of becoming a factor in extending the service life of postwar tires to more than double the present mileage life, was discussed by Lt. Col. C. W. Vogt, Chief, Technical Staff for Supply, Transportation Corps, War Department, Washington, D. C., at the National Transportation and Maintenance Meeting held by the Society of Automotive Engineers at the Bellevue-Stratford in Philadelphia, Penna., on June 28 and 29.

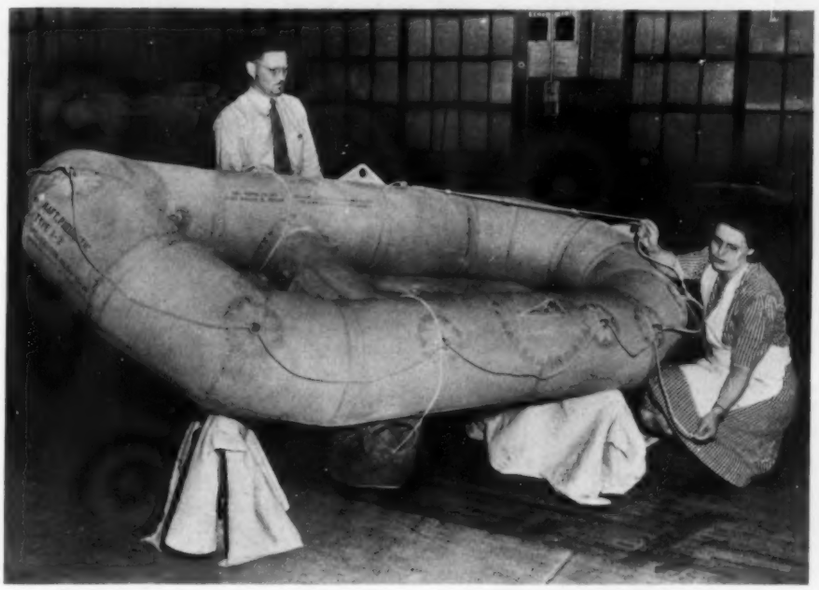
The device, a 500-pound mobile military unit, designed to effect repairs at any time and to replace Army tire repair equipment weighing tons and taking hours to operate, consists of a press ram equipped with an electrode coupled to a high-frequency generator, and a press frame. It applies "internal heat" to make spot and sectional cures within minutes. The ram and frame, fitted with filler bags which adjust themselves under pressure to tire contours, obviate the use of molds, effect repairs on any size tire, and eliminate such vulcanizing hazards as destructive over-heating of adjacent sections. The device was developed by Col. Vogt and Eino Lasko in the Forest Products Laboratory at Madison, Wisconsin.

In discussing the equipment, Col. Vogt said that one little known fact which was learned during the development work is that livelier cures are made by the few minutes application of "internal" heat as contrasted to an hour or more of impressed or external heat. Contact with the heated molds for an hour or more causes a heat embrittlement of the outer tire surface, resulting in appreciably reduced mileage from this embrittled and case-hardened rubber.

"In simple terms," said Col. Vogt, "in order to produce the proper heat in the center of the rubber tire mass, an excessive heat has been necessary, time and temperature-wise, on the outside of this mass. This applies not only to repairs and recapping but also to new tire manufacture. Probably the reason that this condition is not more widely known is that apparently no means has been available heretofore to overcome excessive surface heat in order to produce proper internal temperature at the core of the rubber."

Discussing the general tire picture before the meeting, J. E. Hale, of the Firestone Tire & Rubber Co., Akron, stated that the exigencies of war are creating a huge, postwar manufacturing capacity which promises to produce synthetic tires low in price, adequate in quantity, and superior in quality. He predicted the current tire shortage will be offset so far as commercial vehicle needs are concerned by growing production of increasingly satisfactory tires, which will give good service but which will demand better care, curtailed vehicle operating speeds in warm weather, and reduced loads.

NEW TYPE LIFEBOAT DEVELOPED BY GENERAL TIRE PREVENTS CAPSIZING



Developed to prevent the capsizal of lifeboats upon which army fliers must depend for their very lives when forced to land in the sea, a new type life raft is now being manufactured by the General Tire & Rubber Company in Akron. A ballast pouch which fills with water and serves as an anchor to keep the boat upright on a stormy sea has been designed for the boat. Other features of the new boat are a boarding ladder so that anyone in the water can easily board the boat; handles on the bottom and inside so it can be easily righted in case it lands wrongside up; and a cross-tube to give more room than was offered by the two seats on the older type boat.

New Propeller De-Icer

Development of a successful and satisfactory electrical de-icer for airplane propellers has been announced by the Goodyear Tire & Rubber Co., Akron. To achieve its purpose, according to report, Goodyear created two new types of synthetic rubber, one a so-called conducting rubber and the other a new abrasion-resisting rubber. The new de-icer consists of a "rubber boot" which fits over the leading edge of the propeller blade. This "boot," although only a few thousandths of an inch thick, consists of three layers of specially compounded synthetic rubber, forming a sort of sandwich. The center layer is the conducting rubber; the bottom layer, which rests on the propeller blade and is easily and quickly attached to it by a cement, is a layer of insulating synthetic rubber; and the upper layer is the new abrasion-resisting synthetic rubber.

Expand Geon Production

Production of the Geon vinyl chloride resins recently introduced by the Chemical Division of the B. F. Goodrich Co. is being increased by an expansion of the company's chemical plant in Louisville, Ky. The expansion, scheduled for completion early in 1945, was requested by WPB so that additional Geon will be available for the war effort. New facilities for the production of the Geon resins have been designed for maximum flexibility of output, so that the straight vinyl chloride polymers, copolymers, or vinyl chloride latex can be produced alternatively as the demand occasions.

British Journal Adds to Title

In recognition of the growing importance of synthetic rubber and in the belief that crude and synthetic rubbers will be allied rather than competitive materials in the postwar period, *The Rubber Age (of London)* has changed its name to *The Rubber Age and Synthetics*. The change was made effective with the June, 1944, issue. This journal is published by the Rubber and Technical Press, Ltd., 147 Grosvenor Road, London, S.W. 1, England.

NAMES IN THE NEWS

JOHN H. ROWE, who has been Chicago manager of the Boston Woven Hose & Rubber Co., Cambridge, Mass., for the past several years, has been made vice-president in charge of western sales, covering the territory from Chicago to the Pacific Coast.

E. B. CONLEY, associated with the Northern Electric Co., Montreal, Canada, for the past several years, has been named cable division buyer of the company, succeeding WILLIAM A. GILBERY, who has retired under the company's age rule.

GEORGE A. IRVIN, who was associated with Goodrich at Akron for seven years, and with Firestone at Los Angeles, for several years, and who joined the Consolidated Vultee Aircraft Corp., at Downey, Calif., two years ago, has been named chief industrial engineer of that company's Vultee field division.

EDWARD JACOBS, for several years manager of the industrial university maintained by the Goodyear Tire & Rubber Co. at Akron, has been named manager of the company's tire plant at Cali, Colombia. He was scheduled to assume his new duties some time this month.

ALBERT GRINDY has been named controller of the Thermoid Co., Trenton, N. J., and of its subsidiaries. A. C. TEETSEL has been appointed manager of the company's frictional materials manufacturing division.

A. C. MICHAELS, formerly superintendent of the Gadsden, Alabama, tire plant of the Goodyear Tire & Rubber Co., who more recently has been acting as superintendent of Plant D of the Goodyear Aircraft Corp., has been transferred to the Litchfield Park, Arizona, factory of the latter organization as plant manager.

J. R. KEACH, associated with the Ohio Rubber Co., Willoughby, Ohio, for the past several years as purchasing agent, has left that company and is now associated with the Firestone Industrial Products Co.

ALLAN W. WALTER, formerly associated with the Firestone Tire & Rubber Co. at Akron, has been elected controller of the Freeport Sulphur Co., New York. JOSEPH A. MULLINS, with Freeport Sulphur since 1934, was named assistant controller.

ROBERT COWEN, for many years technical superintendent of the Quabaug Rubber Co., North Brookfield, Mass., is now with the Office of the Rubber Director, at Washington, D. C., as manager of scrap and reclaim.

Reel Named Vice-President

Ralph M. Reel, who has been associated with the Pharis Tire & Rubber Co., Newark, Ohio, since 1926, holding positions as chief chemist, factory superintendent and factory manager, has been appointed vice-president in charge of manufacturing of that company. At the same time it was announced that William Bachout has been named comptroller of the company. Before coming to Pharis, Mr. Bachout was associated with the Eclipse Division of the Bendix Aviation Corp.

VALLY N. BRADEN, associated with the Goodyear Tire & Ruber Co., Akron, for the past 27 years, most recently as superintendent of the balloon and airship division, has left that organization and has joined the Vulcan Proofing Co., Brooklyn, N. Y., as manager of design and production.

THEODORE LYMAN, who has been acting as superintendent of services at the government-owned copolymer plant at Baytown, Texas, operated by the General Tire & Rubber Co., in conjunction with the General Latex & Chemical Corp., has been appointed general manager of that plant, succeeding HARVEY J. ELWELL, who is returning to his post as president of General Latex. CHESTER A. BROWN has been named assistant general manager of the plant.

J. E. POWERS, who has been serving as manager of the New York branch of the General Tire & Rubber Co., has assumed special sales duties in the company's tire department in Akron.

H. M. RAMSEY, associated with the U. S. Rubber Co. since 1935, most recently as division manager of fuel cell production at Detroit, has been appointed sales manager of the tractor and implement tire division of the company. He will make his headquarters at Detroit.

JAMES E. SELLERS, until recently chief engineer of WPB where he supervised conversion of many plants to war production, has joined the Plastics Industries Technical Institute, Los Angeles, as engineering consultant of its research division.

"KASEY" YOUNGENTOB, until recently associated with the laboratories of Valentine & Co., has joined the Smith Chemical & Color Co., Inc., Brooklyn, N. Y., as technical advisor and field representative.

GOLF TOURNAMENT FEATURES RHODE ISLAND CLUB OUTING

The feature of the outing held by the Rhode Island Rubber Club at the Wannamoisett Golf Club, East Providence, R. I., on June 16 was the usual golf tournament. Approximately 60 members and guests attended the outing, for which Owen E. Lowe, president of the rubber group, acted as chairman.

Winners of the various events in the golf tournament, all of whom received prizes, were as follows: *Low Gross*—A. B. Lloyd (Lloyd Mfg.) and W. Newman (Goodyear Footwear); *Low Net*—S. Tinsley (Vanderbilt), W. Stafford, L. Yates (Industrial Paper Cordage) and H. W. Greenup (Firestone), all tied for first place, and George Wilson (Wilson Co.); *Most Pars*—E. Colligan (Plymouth Rubber); *Most 5's*—F. Bartlett (U. S. Rubber); *Most 7's*—George Hill (Lloyd Mfg.); *Blind Bogey*—H. Bainbridge (C. K. Williams); *High Gross*—W. K. Priestley (U. S. Rubber); *Biggest First Hole*—H. A. Stawnick (Firestone).

The prizes were made available by contributions received from the following firms: American Cyanamid & Chemical Corp., Binney & Smith Co., Bunatak Chemical Co., Godfrey L. Cabot, Inc., Carbro Chemical Co., Cleveland Liner & Mfg. Co., E. I. du Pont de Nemours & Co., Wm. D. Eggelston Co., General Atlas Carbon, Imperial Paper & Color Corp., Ernest Jacoby & Co., Monsanto Chemical Co., New Jersey Zinc Sales Co., Pequanoc Rubber Co., Henry L. Scott Co., Solar Compounds Corp., Standard Chemical Co., Taylor Instrument Cos., Titanium Pigment Corp., R. T. Vanderbilt Co., L. G. Whittemore, Inc., Wilbur Chemical Co., Wilmington Chemical Co.

Expands Production Facilities

To meet increased war production demands, the U. S. Rubber Co. has established new manufacturing facilities in seven cities scattered in six eastern and mid-western states. In addition, the company is expanding present plant facilities at four of the 38 plants which it now operates. The new manufacturing operations include production of rayon cord at Scottsville, Va.; Signal Corps wire at Lowell, Mass.; Army raincoats at Ligonier, Ind.; special military equipment at Worcester, Mass.; special invasion equipment at Manchester, N. H. and Grand Rapids, Mich.; and asbestos and footwear parts at Beacon Falls, Conn. A new plant at Hogansville, Ga., built last year, is being doubled in size to permit expanded production of lightweight asbestos yarn needed for fire-fighting suits and other vital war items. Tire plants are being expanded at Chicopee Falls, Mass., and Los Angeles, Cal. At Eau Claire, Wis., the company's tire plant is being reconverted from the production of small arms ammunition and greatly enlarged.

CONTINENTAL CARBON'S PLANT IS NOW IN FULL OPERATION

The furnace black plant at Sunray, Texas, of the Continental Carbon Co., which maintains headquarters at 295 Madison Avenue in New York City, recently went into full operation. Attending the opening ceremonies were executives of both the Continental Carbon Co. and the Witco Chemical Co., exclusive distributors of Continental blacks. The furnace blacks produced at the new plant will help to alleviate the demand for this type of black, which incorporates low heat generating characteristics in GR-S compounds.

Continental Carbon's new line of Continex furnace blacks were developed especially to meet the needs of the synthetic rubber compounders. Many months of careful analysis, laboratory development and pilot plant operation went into establishing the optimum operating characteristics and the standards of quality control that must guide large scale production. This development program was started well before construction of the plant units was begun.

Because of the flexibility of the type of furnace used in the new Continental plant, it was stated, plans call for eventual production of medium loading reinforcing in addition to the medium loading semi-reinforcing furnace blacks. Since the new Sunray plant is adjacent to the 160-acre channel black plant which Continental erected at a cost of over $1,000,000 six years ago, the company will be able to ship mixed carloads of furnace and channel type blacks.

Firestone Exhibits War Products

An impressive public exhibit of the innumerable war products made by the company was staged early this month by the Firestone Tire & Rubber Co. and subsidiary companies, at the Waldorf-Astoria Hotel in New York City. Automotive and aircraft specialties, pontons, invasion boats, gas mask parts, fuel cells, delousing equipment, and barrage balloons were among the rubber and plastic products shown. Of special interest to the public were the anti-aircraft guns, self-catapulting auto-giro, 500 and 1,000-pound bombs, and non-shatterable oxygen cylinders and tanks used for high altitude flying. Velon fabrics were on display. The production of both natural and synthetic rubber was shown. All in all, it was a comprehensive display of the wartime rubber, plastic and steel products made by the company.

Harmon Appoints Caldwell Co.

Harmon Color Works, Inc., Paterson, N. J., has announced the appointment of the Caldwell Co., First Central Tower, Akron 8, Ohio, as sole distributors of the company's colors to the rubber industry in the United States and Canada. The Caldwell concern will shortly release information on a new and interesting development in the field of master-batched colors.

Additional "E" Awards

Included among companies receiving the Army-Navy "E" award in recent weeks for production efficiency were the following:

General Cable Corp., Bayonne Plant, Bayonne, N. J.

Goodyear Clearwater Mills, Cedartown, Georgia.

Goodyear Clearwater Mills, Rockmart, Georgia.

Mansfield Tire & Rubber Co., Mansfield, Ohio.

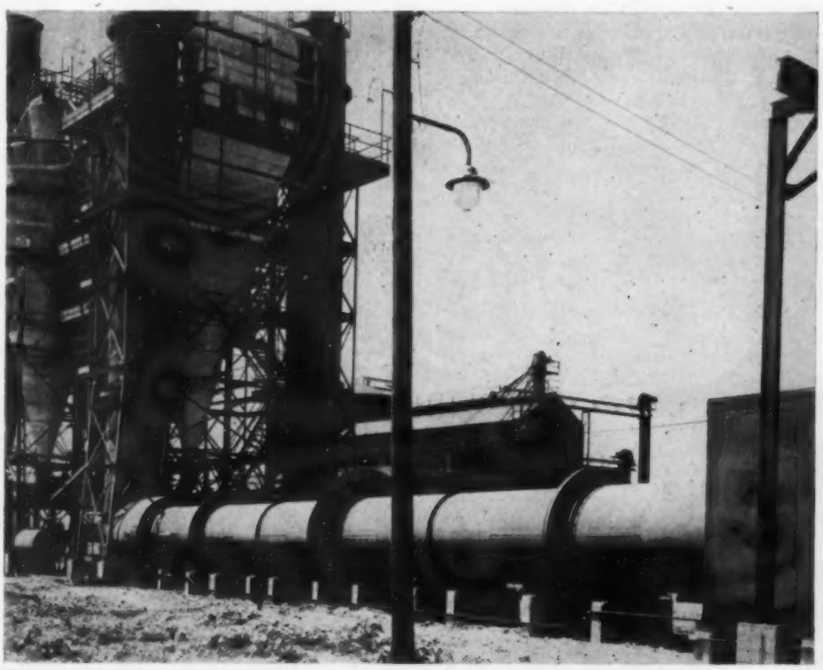
Oak Rubber Co., Ravenna, Ohio.

U. S. Rubber Co., Bristol Plant, Bristol, R. I.

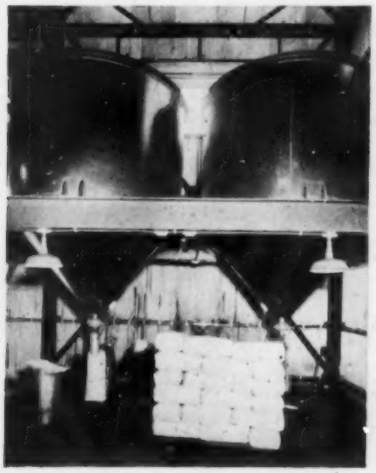
U. S. Rubber Co., Stark Mills, Hogansville, Georgia.

In addition to the above, renewal stars, indicating continued efficiency, have been awarded to the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J., and to the St. Joseph Lead Co., Josephtown, Penna.

Among those attending the formal opening of the new plant were R. I. Wishnick (second from right) and Julius Tumpeer (second from left), president and vice-president, respectively, of the Witco Chemical Co. Others shown in the photo are directors of the Continental Carbon Co.



Here is a general view of Continental Carbon's new furnace black plant at Sunray, Texas, showing the ducts in the foreground with the precipitators in the center background.



Some of the packaging tanks in the new Continental furnace black plant at Sunray, Texas, are seen in this view.

CANADIAN NEWS

The Wartime Prices and Trade Board has issued Administrator's Order No. A-1265, effective June 26, relating to synthetic rubber for use in elastic fabrics. The order is signed by J. H. F. Turner, Cotton Administrator. The order revokes Administrator's Order A-1145 covering neoprene for use in elastic fabrics and the following is substituted:

1. This order shall become effective on and after June 26, 1944.

2. A manufacturer may use synthetic rubber thread as a substitute for natural rubber thread in the manufacture of fabrics which he produced in the base period September 15 to October 11, 1941, provided that

(a) the weight of synthetic rubber elastic thread a person uses in the manufacture of each yard of fabric of any kind must not be less than the weight of natural rubber elastic thread he used in the manufacture of each yard of fabric of the same or substantially the same kind, which he sold during the said basic period.

(b) The maximum price at which a manufacturer may sell any fabrics containing synthetic rubber elastic thread shall be the highest price at which during the said basic period he sold the same or substantially the same kind of fabrics containing natural rubber elastic thread.

A. H. Williamson, Rubber Controller, recently stated in Toronto, that there will be no new automobile tires for civilians until 1945 unless they are engaged in essential war work and qualify under the government's tire-rationing order. Conferring with members of the Rubber Association of Canada, representing 16 major rubber firms principally in Ontario and Quebec, Mr. Williamson said that while tires available for essential civilian use will be increased this year over last year and 1942, the increased production will be sufficient only to provide tires for motorists who qualify under A and B categories.

"There will be no change this year in the categories of persons entitled to new tires," he said, adding that "the needs of the armed forces are being met adequately by the rubber industry. The remaining problem is to complete conversion from crude to synthetic rubber."

J. I. Simpson of Toronto was re-elected president of the organization and P. C. Jones of Montreal, was returned as vice-president. Members elected to the board of directors included Mr. Jones and W. H. Miner, of Granby, Quebec.

United States and Canadian industrialists have done in two years what, in peacetime, would have taken ten years, when it became evident in 1942 that it was essential to produce synthetic rubber to win the war, E. B. Babcock, Assistant Rubber Director of the United States, told the 40th Annual General Meeting of the Canadian Transit Association at Quebec on June 28.

"The first phase of this great task," he said, "was the planning, building and putting into production of plants to produce synthetic rubber; the phase is now nearing completion. It has been perhaps the biggest single engineering and construction job ever tackled, but it has been done. Approximately 70,000 tons of synthetic rubber were made in Canada and the United States last month. Production will continue to increase until 85,000 tons per month are available—or more than 1,000,000 tons per year."

Mr. Babcock said that such a production was achieved while the heavy war production program for such articles as life rafts, barrage balloons, pontoons, bullet-sealing tanks for fuel for aircraft, and rubber clothing supplies was kept at a high peak.

"The engineers and chemists of the United Kingdom have participated fully in this program," Mr. Babcock said, "and the same changes to synthetics are being made by the industry in England as are being made here. The Canadian and United States Government bureaus and rubber industries have worked as one unit.

"Here in Canada, you are leading in production of civilian rubber goods from synthetics because the rubber facilities and manpower have been available at an earlier date. At Sarnia, Ont., is located the most complete synthetic rubber unit of the entire program."

The British Rubber Company's plant at St. Laurent, Quebec, was completely destroyed by fire in the early morning of June 13, with loss running into hundreds of thousands of dollars. The outbreak occurred in the neighboring plant of the Industrial Glass Company, Ltd., and spread in a few minutes to the rubber factory. Steel girders bent and collapsed in the heat of the flames and both plants were left as a heap of rubble and twisted steel.

William H. Miner, president and general manager of the Miner Rubber Co., Ltd., Granby, Quebec, is being prominently mentioned in Eastern Township political circles as the logical successor to the late Senator Rufus Pope. Originally there were four English-speaking representatives among the 24 senators from Quebec and, with the death of Senator Pope, there are now only three, it is pointed out. This particular section of Quebec Eastern Townships has never had a senator and Mr. Miner, descendant of one of the pioneer families of Quebec, is considered by many as the right man to fill this vacancy among Quebec's English-speaking delegates to the Senate.

Many war inventions have a bright prospect in post-war economy and will provide new opportunities for Canadian industry, according to Hon. C. D. Howe, Minister of Munitions and Supply. In an address prepared for delivery to the Canadian Manufacturers' Association, Mr. Howe urged Canadian manufacturers to give technical developments of the last four years consideration in their post-war planning. He said the government-owned Polymer Corporation's synthetic rubber plant at Sarnia, Ontario, was a "gold mine as a source of raw materials for a variety of products," and added that the plant should become the center for a number of important secondary industries.

The Wartime Prices and Trade Board and the Department of Munitions and Supply are attempting to improve the rubber used for preserve jar rings, Douglas Abbott, Parliamentary Assistant to the Minister of Finance, recently announced. Complaints had been received that the jar rings available last year allowed preserves to go bad. Synthetic rubber is not suitable for the rings and the government is attempting to find high class reclaimed rubber for the purpose.

Directors of Goodyear Tire and Rubber Company of Canada, Limited, have declared a regular quarterly dividend of 63 cents per share on common and 62½ cents per share on preferred stock, both payable July 3, to shareholders of record June 15.

A Department of Munitions and Supply spokesman said on July 4 that the sale of inner tubes will continue to be subject to rationing regulations in Canada and that manufacturing facilities were being used for war and other essential purposes. He was commenting upon a Washington dispatch saying that all tire inner tubes will be removed from rationing in the United States beginning July 1. The announcement, quoting the Office of Price Administration, said inner tube inventories now were sufficiently large to supply the needs of all motorists.

BOSTON GROUP'S 1944 OUTING ATTRACTS RECORD ATTENDANCE

Approximately 290 members and guests, the largest turn-out ever recorded at any outing of the group, attended the combined Outing and Summer Meeting of the Boston Rubber Group, held on June 23 at the Woodland Golf Club, Newton, Mass. The outing committee was headed by Charles E. Reynolds (Cambridge Rubber), assisted by Richard K. Patrick (Windram). Activities included a golf tournament, darts, horse shoe pitching and racing, and a fiercely contested soft ball game between L. C. Shaw's "Wild Cats" and T. C. Ashley's "Bear Cats," the latter team winning by a score of 6 to 5. W. Lyman (Avon Sole) won the dart throwing contest.

The highlite of the outing, as usual, was the golf tournament, with honors for the various events going to the following: *Kicker's Handicap*—F. G. Shinick, E. V. Osberg and S. V. Sharen; *Low Gross*—E. B. Curtis and E. Colligan; *Low Net*—A. Greenbaum, Walter Ritz and Charles Kees; *Nearest Pin*—W. B. Richardson and M. E. Nourse; *Most 5's*—H. C. Simmonds; *Most 8's*—R. E. McCurdy; *High Gross*—L. B. Burnham. Mr. Colligan handled the golf tournament, while Don Wright handled the horse racing games and W. C. Weller the dart contest.

An excellent lobster dinner was served in the evening, following which some group singing was led by John Hach. Door prizes were distributed to all those present. These prizes were made possible by generous donations received from the following concerns:

Acushnet Process Co., Akron Standard Mold Co., L. Albert & Son, Aluminum Flake Co., American Bleached Goods Co., American Cyanamid & Chemical Corp., American Mineral Spirits Co., American Resinous Chemical Co., American Zinc Sales Co., Anaconda Sales Co., Angier Products Co., Archer Rubber Co., T. C. Ashley & Co., Atlantic Refining Co., Avon Sole Co., Baldwin Locomotive Works, Barrett Co., Binney & Smith Co., Boston Woven Hose & Rubber Co., Brockton Machine Co., Brooklyn Color Works, Bunatak Chemical Co., Godfrey L. Cabot, Inc., Calco Chemical Div., Chemical Pigment Co., Callaway Mills, Cambridge Rubber Co., Carbide & Carbon Chemicals Corp., C. F. Church Mfg. Co., Cleveland Liner & Mfg. Co., Coated Products Co., Commercial Solvents Corp., Continental Carbon Co., Continental-Mexican Rubber Co., Converse Rubber Co., Deecy Products Co., Delco Rubber Co., E. F. Drew & Co., E. I. du Pont de Nemours & Co., Wm. D. Eggleston Co.

Also C. E. Gale Co., General Atlas Carbon, General Dyestuffs Corp., General Latex & Chemical Corp., General Magnesia & Magnesite Corp., Great Falls Bleachery & Dye Works, Givaudan-Delawanna, Inc., Haartz-Mason-Grower Co., Alfred Hale Rubber Co., Hercules Powder Co., Hird & Connor Inc., Hodgman Rubber Co., Holliston Mills, Hood Rubber Co., J. M. Huber Co., Hycar Chemical Co., Imperial Paper & Color Corp., *India Rubber World*, Innis, Speiden & Co., Ernest Jacoby & Co., Keystone Lubricating Co., D. H. Litter Co., Malrex Chemical Co., Merrimac Chemical Co., Monsanto Chemical Co., Moore & Munger, H. Muehlstein & Co., Naugatuck Chemical, New Jersey Zinc, Niagara Sprayer & Chem. Co., A. C. Nispel Inc., Oakite Products, Inc., O'Dell Coated Fabric, Pacific Mills, Inc., Panther-Panco Rubber Co., Pennsylvania Ind. Chem. Corp., Pequanoc Rubber Co., Philip Brothers Inc., Pittsburgh Plate Glass Co., Plymouth Rubber Co., Pond Lily Co.

Also Pratt & Lambert Co., R. B. H. Dispersions, Raffi & Swanson, Inc., Respro, Inc., Rex-Hide, Inc., John Royle & Son, Sanford Mills, A. Schrader's Son, A. Schulman, Inc., Henry L. Scott Co., Sessions-Gifford Co., Shell Oil Co., Socony-Vacuum Oil Co., Stamford Rubber Supply Co., Stanco Distributors, Inc., Standard Chemical Co., Standard Lime & Stone Co., Standard Ultramarine Co., Stanley Chemical Co., Stedfast Rubber Co., Stewart Bolling & Co., Stowe-Woodward Inc., Sun Oil Co., C. J. Tagliabue Mfg. Co., Taylor Instruments Co., Texas Co., Thiokol Corp., Wm. R. Thropp & Sons Co., Tillotson Rubber Co., Titanium Pigment Co., Turner Halsey Co., Tyer Rubber Co., Union Bay State Co., United Carbon Co., R. T. Vanderbilt Co., Vansul & Co., Waltham Bleachery, Warwick Chemical Co., Weller Chemical Co., Wilmington Chemical Co., Chas. T. Wilson Co., Witco Chemical Co., Woburn Degreasing Co., Xylos Rubber Co.

Acquires Arrowhead Rubber Co.

Acquisition of the Arrowhead Rubber Co., 2244 East 37th St., Vernon, Calif., has been announced by the National Motor Bearing Co., Inc., of Redwood City, Calif., manufacturers of shims and oil seals of all kinds. Although Arrowhead becomes a wholly-owned subsidiary of the National concern, Harry Franklin will continue as president and general manager, along with the present staff of executives. Lloyd A. Johnson, president of the National Motor Bearing Co., becomes chairman of Arrowhead's board of directors, while Frederick E. Barth, manager of National's industrial division, will also serve on the board. Milton B. Bulkeley, National's treasurer, will serve in a similar capacity for the new subsidiary company.

Chicago Outing on July 22

A combined "stag" and outing will be held by the Chicago Rubber Group on Saturday, July 22, at the Lincolnshire Country Club, Steger, Ill. Dinner and golf are included in the price of $3.75 per person and prizes will be awarded to winners of various events. Charles E. Wonder (Van Cleef Bros.) is chairman of the Golf Outing Committee.

SOME OF THE ACTIVITIES AT THE BOSTON RUBBER GROUP OUTING

TOP, left to right: Joe Haas (Hodgman), J. A. Johnson (Hodgman), Emil Krismann (DuPont) and W. O. Hamister (Naugatuck); H. T. Mason (Quabaug); Harold Fuller (Pequanoc) and John Hach (R.M.A.); A. J. Mease (DuPont), D. Cockburn and R. L. Heinz (DuPont); W. A. Appletoft (Plymouth). BOTTOM, left to right: S. Zulick, Ed Denzler, Fred Bommer and Phil Young, all of Acushnet Rubber; Walter Ritz (Union Bay State), E. L. Hanna (Davol), Jake Ruppert (Caldwell) and Frank Ward (Panther-Panco); Joe Haas (Hodgman) and J. R. Geenty (Sanford Mills); Charles Reynolds (Cambridge), chairman of the outing committee. All photographs taken by George W. Smith (DuPont).

LOS ANGELES NEWS

By the Fourth of July it was taken for granted the annual outing of the Los Angeles Rubber Group this year would be a grand success, a full house being assured. The dates for the big outing are July 22 and 23, Saturday and Sunday. A sufficient number of prizes had been donated by July 10 to insure every man there one or more prizes.

The plan as in past years is to gather shortly after noon on Saturday and stay over until late afternoon on Sunday. The event is slated to have a military theme but the manner in which this theme is to be worked out has not been revealed. The Uplifters' Club at Santa Monica is the spot.

All manner of contests and competitions are on the slate and an official photographer has been engaged. The formal part of the program is being dug up by Leon Horchitz, while the leg work is being done by a number of fellows all of whom have always taken a keen interest in Group affairs.

The big outing, an outing which last year took on a "Forty-niner" theme, takes the place of the deep sea fishing party which was an annual feature for many years, but necessarily discontinued since the opening of war.

The Patterson-Ballagh Corporation, 1900 E. 65th Street, is in the midst of a building expansion program which will materially increase the floor space. The addition is in keeping with the architecture of the building which the company has occupied for many years. At the moment it looks like it would take sixty days or so to complete the job.

Work on the addition to the B. F. Goodrich Company plant is being pushed as rapidly as possible with no date set apparently for the final installation of equipment and the first turning of the wheels.

Ed Royal, of H. M. Royal, Inc., is spending part of his summer in a cottage by the sea. Due to the unusually cool summer (some call it cold) this year in Los Angeles few people are spending as much time at the beach as is customary.

Donations of blood at the Goodyear plant this summer has reached a large total. When the mobile unit visited the plant late in May the total number of donors during the two days was 298, each contributing a pint.

There is something especially sad for the people at Goodyear in the accidental death of M. G. Secord, Goodyear flying ace. Secord had just returned from the south Pacific where in a half dozen different spots he had dodged deadly bombs by the scores and had gone through several severe tropical storms. After reaching home he was accidentally killed while driving from a near-by beach to the plant. He is survived by his mother and one sister.

Charley Kuhn, of Standard Rubber Company, Inc., is absent from Los Angeles on a trip to Peru, South America. Mr. Kuhn spent his boyhood in that country. He expects to be gone for some time.

Bill VonderReith, of the Sierra Rubber Company, has returned from a trip to Seattle. The journey was one of those which combine business with pleasure.

Jack Britton, of Stanco Distributors, Inc., was one of the out-of-towners reported as making plans to be in Los Angeles in time for the annual outing of the Los Angeles Rubber Group. Mr. Britton is a regular visitor in the city and is a member of the Group.

Laura McCabe, Goodyear employee, is proud of a gift she has recently received from her son Tom, now serving in the south Pacific with the U. S. Marine Corps. The gift is a captured Japanese rifle, 25-calibre, taken at Bougainville.

Mrs. McCabe is a good example of a woman who in spite of the fact that she is old enough to be the mother of a U. S. soldier, is glad to be doing her bit for the country in a war plant. She has been employed at Goodyear now for about 20 months.

To Make Plating Equipment

The formation of the Industrial Hard Chromium Plating Equipment Corporation at Newark, N. J., to manufacture plating equipment based upon entirely new principles of design and operation, was recently announced. William A. Crowder, who has been president and sole owner of the Industrial Hard Chromium Co. of Newark since 1937, also heads the new company as president.

OBITUARIES

Arthur Dyer

Arthur Dyer, vice-president of the Laurel Co., Garfield, N. J., died at his home in Freehold, N. J., on June 14, after a brief illness. He was 77 years of age. In addition to his connection with the rubber company, Mr. Dyer had also been president of the Passaic and Delaware Realty Co. and of Allwood Manor, Inc. He was also a member of the board of education and a director of the Central National Bank in Freehold. For almost fifty years, Mr. Dyer was a member of the New York Produce Exchange and served four terms on its governing board. A widow, a son and three daughters survive.

Aleck Bauer

Aleck Bauer, chairman of the board of the Kendall Co. and founder of Bauer & Black, surgical dressing manufacturers, died in the Michael Reese Hospital, Chicago, on June 11, at the age of 81. Born in Germany, Mr. Bauer came to the United States as a youngster. He organized Bauer & Black in 1893. When that company was acquired by the Kendall Co., of Boston, in 1928, Mr. Bauer became chairman of the latter concern. A widow and daughter survive.

Joseph S. Bennitt

Joseph S. Bennitt, manager of the sporting goods division and head of the war contracts division of the Seamless Rubber Co., New Haven, Conn., died recently at the age of 59. Mr. Bennitt first entered the sporting goods field in 1915 and in 1920 became associated with the Winchester Repeating Arms Co. in New Haven, serving with that company for many years. In 1930 he joined Seamless Rubber as manager of its sporting goods division and in 1942 took on the additional task of handling all of the company's war contracts. A widow and son survive.

Raymond S. Willis

Raymond Smith Willis, one-time vice-president of the U.S. Rubber Co., died at his home in Evanston, Ill., on July 2, at the age of 69. He leaves a widow, a daughter, and a son, Lt. Raymond S. Willis, Jr., of the Navy, who is assistant dean of men at Princeton University.

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Right now . . . is a good time to plan for identifying and decorating your postwar rubber products . . . with Meyercord's Elasti-Cals. These colorful, high-visibility nameplates stretch with and become a smooth, edgeless part of any rubber surface to which they are applied. Varying degrees of flexibility permit quick adaptation to many different requirements . . . for identifying or decorating sundries or heavier rubber products.

Elasti-Cal's patented composition requires far less rubber than conventional rubber labels. Their ease of application, in the mold or by cold methods, permits fast line production . . . with life-of-the-product durability. Any size, any design, in any number of colors can be reproduced . . . for trademarks, operating instructions, insignia, or for decorative use on a wide variety of postwar products. Investigate the new efficiency and postwar possibilities of ELASTI-CALS. Free designing and technical service. Samples and details on request. Address all inquiries to Dept. 56-7.

IMPORTANT

Meyercord's patented Elasti-Cal process, regularly used for colorful nameplates, trademarks and decoration on a wide variety of civilian rubber products is still available . . . BUT FOR WAR USE ONLY.

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Since originating the Capitol Process Liner Treatment, we have processed many million yards of cotton piece goods for all types of rubber companies.

These millions of yards of Capitol Liners have given efficient service for two reasons. First, we have usually finished a sample liner without charge so it might be tested on the job and thus ascertain its suitability for the purpose in mind. Second, production and repeat orders are always processed to the same uniform quality standards.

These millions of yards have resulted in untold economies in cotton piece goods. Liners processed with our Capitol Treatment have a considerably longer life than those not treated. Therefore, purchases of piece goods have not had to be made so frequently and thus many, many yards of cotton goods have been made available for other vital War needs. Capitol Liners longer life means that over a period of time, they literally "pay for themselves."

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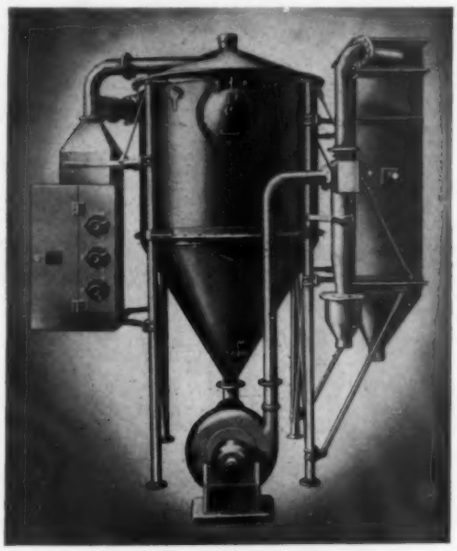
New Type Turbulaire Spray Dryer

The development of a new type of Turbulaire Spray Dryer to meet an increasing demand for an inexpensive, small-capacity spray dryer for the commercial drying of high value products, for use in laboratory research



and in pilot plant operation on specific materials, has been announced by the Western Precipitation Corp., 1016 West 9th St., Los Angeles 15, Calif.

Called the Type N Dryer, the new unit is said to offer a number of advantages for drying products such as fine chemicals and pharmaceuticals, and for investigation of spray drying problems. It is furnished in black iron, stainless steel or other alloys, and standard equipment includes electric heater, 4-foot desiccator with cone bottom and hand-operated mechanism for sweeping surface accumulations from the conical section, Multiclone collector, fan, bag house and control instruments mounted on a single frame for maximum compactness and ease of installation.

Maximum operating flexibility of the Type N Dryer is gained by means of optional heaters—either direct or indirect types—and other equipment designed to meet the special needs and facilities encountered in various applications. In addition, the desiccating chamber is provided with a secondary inlet for introducing tempering air at inlet temperature, or precooled to any desired temperature. This permits investigation, for example, of the dryability of thermoplastic and heat sensitive materials as well as those having a tendency to case-harden. Other optional equipment includes a high efficiency air filter for use in processing pharmaceuticals, food products, etc., and sealed glass sight ports for inspection purposes.

The Type N Spray Dryer is rated at an evaporation of 25 pounds of water per hour at an inlet-to-outlet temperature differential of 300° F. Varying conditions such as type of material handled, concentration of solids in the feed, etc., will, of course, cause this figure to vary well above or below the rated capacity.

Norelco X-Ray Diffraction Unit

A new X-ray diffraction unit, which is said to readily solve analysis problems which formerly were considered impossible in the chemical, metallurgical and scientific fields, has been perfected by the North American Philips Co., 100 East 42nd St., New York 17, N. Y. The new unit—called the Norelco X-Ray Diffraction Unit—can be used with a newly-developed, low-angle-scatter camera or with other standard types of cameras.

The new Norelco X-ray diffraction unit has a four-windowed tube enclosed in a bronze housing. Diffraction patterns of four different specimens can be obtained simultaneously. A number of types of X-ray tubes can be provided included in which are targets of tungsten, molybdenum, cobalt, iron, chromium and copper. Tubes can be changed quickly, usually in 2 minutes, using only a screwdriver.

Fully shockproof and rayproof, the unit utilizes full wave rectification which permits higher output and longer life from the tube. Filament current supply is stabilized, control of kilovoltage and milliamperage is smooth and stepless, tube is protected automatically if water supply fails, the equipment has start-stop push-button control, and provision is made for use of auto-

matic exposure timer. The slanted panel is indirectly lighted for easy observation and carries, in addition to controls mentioned above, a 0 to 50 milliampere meter, main line switch with overload circuit breaker, calibrated peak-kilovoltage selector, and a pilot lamp. There is also an elapsed-time meter (calibrated in hours and tenths of hours) that serves for long exposures and for recording tube life.

The X-ray diffraction unit is fully shockproof, due to interlocking switches which prevent the transformer from being energized when sides of the unit are open. Precision optical-type camera tracks are available as optional equipment. Adjustments and associated locking devices for adjusting cameras are positive in action. Tracks and supports can be removed readily, leaving the table top clear for use with special apparatus such as the Weissenberg goniometer.

The low-angle-scatter camera is a most outstanding recent development of the North American Philips organization. For example, with this accessory, X-ray diffraction can now differentiate between hard and soft chrysotile in asbestos fibers coming from different geographic locations. In the past, these silky fibers were alike by known methods of analysis—yet showed marked differences under conditions of application.

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A good value. Very active. High Magnesia content, low in impurities. Medium density.

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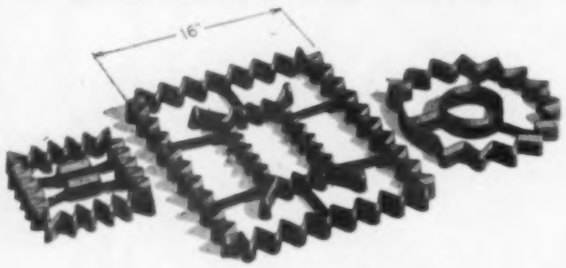

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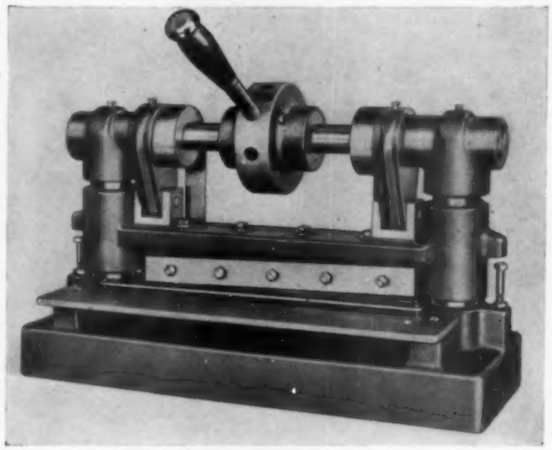
Di-Acro Shear No. 3

Said to incorporate in one unit more features and facilities for shearing and blanking out parts and pieces to die shapes, with die accuracy, than any other commercial shear currently on the market, the Di-Acro Shear No. 3 has been introduced by the O'Neil-Irwin



Manufacturing Co., Minneapolis 15, Minn. This model, like others offered by the company, will quickly and accurately shear rubber, plastics and a great variety of other materials, and finds application both in the plant and laboratory.

The construction of the new cutting machine is reported to include such qualities as a precision adjustment for accurately stopping blade travel, which permits the shear to be readily arranged for a large variety of slitting and notching to extremely close tolerances. A metal stripping guide, moving with the shear blade, is mounted on the unit, and allows the unit to be employed for stripping all types of materials, within the capacity of the shear, to extremely narrow widths. A delivery chute, built within the unit, delivers all materials, fabrics and tissues at any speed within the ability of the operator to feed the shear.

The new Di-Acro Shear is of exceptionally heavy and rugged construction, the main bed casting of machine tool grey weighing 80 pounds. The finished unit weighs in excess of 150 pounds, with all moving parts properly weighed and balanced to distribute shearing load, thus providing a unit which can be easily operated. All bearings are fully adjustable for wear and alignment, and rifle drilled for complete lubrication to all points of friction.

Both shear blades of the new unit are adjustable for tolerances in shearing as well as for the control of the angularity of pitch which can be quickly varied as desired for the shearing of all types of materials, ranging from heavy steel sheet and spring-tampered materials, within the capacity of the unit, to the very lightest of fabrics and tissues, all of which can be sheared without buckling or knurling.

The **National Mity-Midget Sander,** reported to be the smallest high-speed, non-stalling block sander available, has been introduced by National Air Sander, Inc., Rockford, Ill. The sander is only 4¼ inches high and 5½ inches long. It weighs only 3½ pounds.

Simulated Sunshine Generator

Development of a "Simulated Sunshine Generator," which, for the first time is said to closely approximate standard summer sunlight through a combination of 15 lamps of various spectral energy emissions, was recently announced by the Hanovia Chemical & Manufacturing Co., Newark, N. J. Tests of the new generator have been made by the Folmer Graflex Corporation of Rochester, N. Y., and that company is using one of the first units produced in connection with photographic apparatus supplied to the armed forces.

Other applications for this light source are reported to be accelerated fading, aging and weathering tests, or wherever materials are involved that should be tested to determine the influence of sunshine. Specific tests covering rubber products are now understood to be under way and further information concerning the operation of the unit insofar as rubber products are concerned await the outcome of these tests.

The 15 lamps in the unit are a combination of four Hanovia S-4, ten Hanovia H-5, and one 1,000-watt tungsten incandescent lamp. The lamps are mounted on a chromium reflector and radiations cover an area of 1,256 square inches, which is equivalent to a circle of 40 inches in diameter.

Compared with data on June sunlight at 40 degrees north latitude assembled by Dr. Edison Pettit, of the Mount Wilson Observatory, and Dr. Wm. W. Coblentz, of the National Bureau of Standards, the simulated sunlight generator provides "somewhat less ultraviolet and visible radiations and about twice as much infrared radiations as does standard sunlight." This is stated to be the closest approximation of standard summer sunshine ever achieved by artificial means, according to a definite measurement of the energy in microwatts per square centimeter. The comparison covered the different wavelengths in angstrom units of ultraviolet, visible and infrared light.

An improved **Truck-Man,** designed for moving skidded loads of one ton or under, has been announced by Yard-Man, Inc., Jackson 74, Mich. One of the important improvements is said to be a patented two-speed drive which makes both a low and a high speed instantly available.

Anything made of iron, steel or its alloys can be easily and quickly etched with a new **Tool Room Metal Etcher** introduced by the Ideal Commutator Dresser Co., Sycamore, Ill. The new etching tool is especially suitable for marking tools, gauges, reamers, dies, punches, jigs, etc. Depth of mark is controlled by etching heat and speed of writing.

Designed especially to extinguish both flammable liquids and fires of electrical origin, a new **All-Out Fire Extinguisher** has been introduced by the National Powder Extinguisher Corp., 50 Rockefeller Plaza, New York City. In use, a chemical stream is ejected which, when activated by heat, forms a dense, heavy, fire-smothering cloud over a flaming area up to 18 feet.

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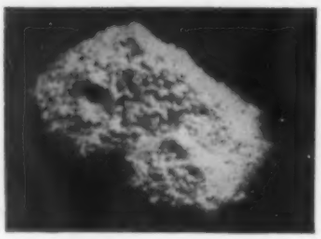

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REVIEWS

BOOKS

A Survey of General and Applied Rheology. By G. W. Scott Blair. Published by Pitman Publishing Corp., 2 West 45th St., New York 19, N. Y. 5½ x 8½ in. 201 pp. $4.00.

The subject of rheology—the relatively new science of the plastic flow, elasticity and deformation of matter—has not had many books devoted to it as yet, although it is reasonable to assume that the number will grow with the years. The few books which have appeared to date have been devoted largely to the theoretical aspects of the subject. The current book is the first to be addressed to the practical rheologist, or, as the author puts it, to "the young physicist, or more often chemist, from whose education, alas, rheology has been almost entirely excluded."

The importance of rheology, and its application to the various arts—rubber, plastics, foods, oils, gases, metallurgy, hydro and aero dynamics, biology—are discussed. Complete, comprehensive treatment of stress-strain-time relations in materials between solids and liquids and the influence of such factors as temperature on them is given. Careful consideration is shown relationships between rheological properties and chemical constitution. Accurate, tested, usable methods are presented with the minimum of higher mathematics. References to rubber, one of the primary rheological materials, appear throughout the text.

The book is divided into two parts, the first devoted to "Rheological Phenomena and Their Measurement" and the second to "Rheological Interpretations and the Evidence of Psycho-Physical Investigations." Each section, in turn, is divided into numerous chapters, covering such subjects as Ideal Materials, Orientation and Surface Phenomena, Rheological Measurements, Theoretical Significance of the Power-Law Relation Between Stress, Strain and Time, Evidence of Psycho-Physics, and General Conclusions. In addition, there is an historical and general introduction, a table of symbols, and a list of abbreviations of technical journals referred to in the text. Complete author and subject indexes are also included.

•

Chemical Machinery. By Emil Raymond Riegel. Published by Reinhold Publishing Corp., 330 West 42nd St., New York, N. Y. 6 x 9 in. 583 pp. $5.00.

Sub-titled "An Elementary Treatise on Equipment for the Process Industries," this book is actually a collection of exact and useful information relating to apparatus and devices used in the chemical industries. Because of the great number of devices which could come under the definition of "chemical machinery," the author has wisely limited his coverage to three specific angles, first giving preference to those devices which have general application, discussing only those which may be purchased from machinery manufacturers as opposed to the "home-made" type, and finally including apparatus designed for large-scale operation.

As the author states in his preface, the treatment is primarily descriptive, and the text material is liberally supplemented with drawings and photographs. Each group of related devices forms a chapter and each chapter has in its introduction a classification in tabular form—a novel feature which should find favor. For each type of device an example is selected and followed long enough to make its construction and operation clear. In many cases the cost of the equipment is indicated for the benefit of the reader, although the prices shown are naturally not binding on the manufacturer. Reading references are given at the end of each chapter.

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REVIEWS (CONT'D)

The Standardization of Volumetric Solutions. (2nd Edition). By R. B. Bradstreet. Published by the Chemical Publishing Co., Inc., 26 Court St., Brooklyn, N. Y. 5½ x 8½ in. 151 pp. $3.75.

This book should prove to be a welcome reference for analytical chemists and laboratory technicians using standardized solutions for analytical purposes. Included in this second edition, which has been thoroughly rewritten and completely brought up-to-date, are the most modern methods of standardization. The book has apparently been written to enable analytical chemists to prepare their standard solutions not only in the most efficient manner but in the shortest possible time. The text is replete with helpful hints, equations, tables of pertinent data, and innumerable references.

The book is divided into eight chapters, as follows: (1) General Considerations; (2) Calibration of Volumetric Apparatus; (3) Indicators; (4) Standard Substances; (5) Standard Solutions of Acids and Bases; (6) Standard Solutions of Precipitation Reagents; (7) Standard Solutions of Oxidizing Reagents; and (8) Miscellaneous Standard Solutions. A carefully cross-referenced subject index is included. The foreword to the book is written by Dr. Harry L. Fisher, of the U. S. Industrial Alcohol Co., while special acknowledgement is made by the author for assistance rendered by Dr. Fisher, V. L. Burger, of U. S. Rubber, and J. B. Lewis, of Standard Oil.

•

The Liquidation of War Production. By A. D. H. Kaplan. Published by the McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y. 5½ x 8¼ in. 133 pp. $1.50.

This book is the result of a research study made by the author for the Committee for Economic Development and covers the cancellation of war contracts and the disposal of government-owned plants and surpluses. The book analyzes the nature and scope of the problems that will confront industry after V-Day, and points out the factors that will have to be given the greatest emphasis and the likely conflict of interests. The author indicates the criteria by which decisions should be made and the responsibilities that will fall on business as well as government. In concluding his book, Dr. Kaplan presents 41 specific points that will enter into any program if it is adequately to meet the problems of war contract cancellation, war plant and surplus disposal.

BOOKLETS, CATALOGS, Etc.

Bricks Without Straw. B. F. Goodrich Co., Akron, Ohio. 7½ x 11 in. 48 pp.

Originally written for members of its own organization, Goodrich has made a limited number of copies of this interesting booklet available to those who have a special interest in its contents. "Bricks Without Straw" is the story of synthetic rubber as told within the Goodrich organization. It traces the development of the synthetic rubber industry and emphasizes the part played by the company in that development, particularly in the period shortly before Pearl Harbor up to the present. Some interesting illustrations are presented in the booklet, including some of the copolymer plants operated by Goodrich for the government.

•

NE Equipment for Rubber and Plastics. National Erie Corp., Erie, Penna. 11¾ x 8¼ in. 36 pp.

The varied line of rubber working and plastic machinery featured by the company is described and illustrated in this booklet. Equipment for automotive tires, molded mechanical goods, wire and cable, proofing, footwear and other branches of the rubber industry is covered. Tubers, strainers, vulcanizers, mixers and presses are among the specific equipment cataloged. The booklet is printed in several colors and is exceptionally well done.

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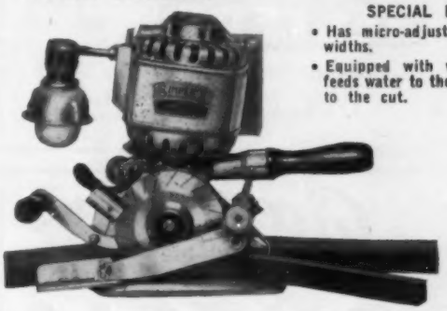

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REVIEWS (CONT'D)

A Summary of Data on Synthetic Rubber. (Revised Edition.) Rubber Manufacturers Association, 444 Madison Ave., New York 22, N. Y. 8½ x 11 in. 36 pp.

This is a revised edition of the summary on synthetic rubber issued by the R.M.A. in November, 1942. Since the first edition was issued, the synthetic rubber program has progressed from the plan stage practically to full production and much new data has been published. The new edition includes much new material, the accuracy of which has been carefully checked with authorities in various branches of the industry. Prepared primarily for the use of editors and others looking for background material on the subject of synthetic rubber, the summary covers Buna S, Buna N, neoprene, Butyl and Thiokol, as well as some of the rubber-like materials, including Koroseal, Vistanex and Vinylite. Some general information on the history and development of synthetic rubber is also given.

•

UL-Symbol of Safety. Underwriters' Laboratories, Inc., 67 East 21st St., Chicago, Ill. 8½ x 11 in. 32 pp.

The current year marks the fiftieth anniversary of the Underwriters' Laboratories, Inc., the non-profit, scientific and technical organization devoted to the safeguarding of lives and property from the hazards of fire, casualty and crime. This anniversary booklet traces the first fifty years of the organization in the service of safety. History, development and growth is covered, and methods of operation outlined. Some of the vast amount of testing equipment used in the laboratories is illustrated and described. Reports of various department heads are included.

•

Clorafin. Cellulose Products Department, Hercules Powder Co., Wilmington 99, Delaware. 8½ x 11 in. 12 pp.

The properties of Clorafin 42, plasticizer, and Clorafin 70, resin, used in the production of fireproof, waterproof and weatherproof coatings for fabrics, are described in this technical booklet. Clorafin 42 is a light-amber, viscous, nonflammable plasticizer and Clorafin 70 is a light-amber, hard, brittle resin. Although these chlorinated paraffins are related chemically, their physical appearance and mode of use are quite different, and they have but few properties in common.

•

A new edition of its *Wheelco Thermocouple Data Book and Catalog* has been announced by the Wheelco Instruments Co., Harrison and Peoria Sts., Chicago 7, Ill. Containing 36 pages, and known as Bulletin No. S2-4, it gives a description of products, prices and recommendations for thermocouple users, and suggests substitutes for restricted materials.

•

The line of *Manger Couplings* featured by the Farrel-Birmingham Co., Inc., Buffalo, N. Y., is described in a new eight-page bulletin (No. 446) recently made available by the company. These couplings are said to provide complete flexibility in one-half the axial space ordinarily required.

•

O'Neil-Irwin Manufacturing Co., Minneapolis 15, Minn., are currently distributing a revised and enlarged edition of their Di-Acro catalog on *die-less duplicating*. Several new improvements are described and illustrated.

•

A new bulletin on its line of *Celectray Pyrometers* (Catalog No. 1101-H) has been made available by the C. J. Tagliabue Mfg. Co., Brooklyn 5, N. Y.

•

Information developed as a result of recent researches into the problems of *galling, seizing and scuffing of metal surfaces* in contact with one another is furnished in an 8-page bulletin (No. 17) recently made available by the Meehanite Research Institute, Pershing Square Building, New Rochelle, N. Y.

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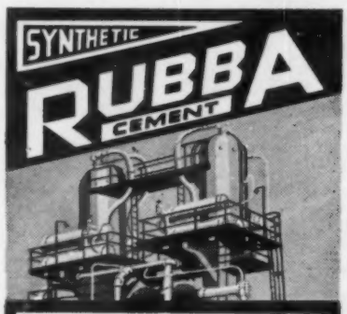

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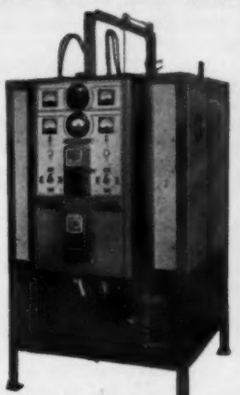

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MARKETS

Rubber – Crude, Reclaimed and Scrap – Cotton – Ducks – Tire Fabrics – Sheetings

NEW YORK, JULY 17, 1944

Crude Rubber

JUST as this issue was going to press, the State Department announced that the United States will participate in exploratory talks in London late this month and early in August with both Great Britain and the Netherlands on postwar problems of crude and synthetic rubber. B. F. Haley, chief of the Department's Commodities Division, will head the American group, and will be accompanied by a number of expert advisors from both industry and government.

This news came shortly after the report that it was quite unlikely that the State Department would commit itself to any international non-restrictive program on rubber because of the complexity of the problems involved and the necessity for making extensive studies to determine the potential of synthetic rubber in the postwar era. This report indicated that no agreement of any kind would be acceptable to the United States until late 1945 or early 1946. It is emphasized, however, that the London talks will be purely exploratory.

Also of special interest during the past several weeks was the vindication of the guayule program by Congress. After first approving the early liquidation of the program, the House reversed itself and by an overwhelming margin decided to continue the program for at least another year. This approval means an appropriation of $3,000,000-odd for the program, to be spent in research, construction and cultivation.

Prices shown below are ceilings established by the Rubber Reserve Company:

	C	N-C
Plantations—		
Ribbed Smoked Sheets, 1X	22½	40
Thick Pale Latex Crepe, 1X	22½	40
Thin Pale Latex Crepe, 1X	22½	40
Thick Brown Crepe, 1X	21¾	38⅞
Thin Brown Crepe, 1X	21¾	38⅞
Thick Remilled Blankets, #1	21¾	38⅞
Rolled Brown or Flat Bark	18	35½
Smoked Blankets, #1	21¼	38⅝
Claro Brand 1XRSS	22½	40
Sole Crepe Trimmings	22	39½
Sole Crepe	22½	40
Wild—		
Uncut Fines, Crude	15	29
Cut Fines, Crude	15½	29¾
Cut Fines, Washed & Dried	22½	40
Upriver Coarse, Crude	12¾	26⅛
Upriver Coarse, Washed & Dried	20¼	37¾
Caucho Ball, Crude	11¾	24¾
Caucho Ball, Washed & Dried	19½	37
Guayule—		
Carload Lots	17⅛	31
Less than Carload Lots	18	31⅛
Balata—		
Surinam Sheet	42½	42½
Manaos Block	38¾	38¾
Colombian Block	38¾	38¾
Peruvian Prime	38¾	38¾
Chicken Wire	23¼	23¼
Latex—		
Normal, Tank Car Lots	26	43½
Creamed, Tank Car Lots	26¾	44¼
Centrifuged, Tank Car Lots	27¾	45¾
Heat-Concentrated, Carload Drums	29½	47

C, for Civilian Use; N-C, for Non-Civilian Use.

Scrap Rubber

For the first time in many months the general market tone in scrap rubber is weak, with few large offerings being made. Supplies, however, are reported still to be plentiful, although the manpower shortage is presenting a problem in moving of stocks. The Scrap Rubber Institute of the National Association of Waste Material Dealers is said to be working on a program which will do much to clear up the complexity of the scrap rubber situation caused by the large amount of synthetic rubber that is now beginning to accumulate in the form of scrap. The program will probably result in a system by which dealers can distinguish markings or some means for easier identification of the synthetic scrap. Prices shown below are ceilings on typical grades of scrap:

(Prices to Consumers, Delivered Akron)

Mixed passenger tires	ton	$20.00
Beadless truck tires	ton	26.00
Mixed truck tires	ton	20.00
Beadless passenger tires	ton	26.00
No. 1 passenger peelings	ton	52.25
No. 1 truck peelings	ton	52.25
No. 2 passenger tubes	lb.	.07¾
Red passenger tubes	lb.	.07½
Black passenger tubes	lb.	.06¾
Mixed passenger tubes	lb.	.06½
No. 2 truck tubes	lb.	.07½
Red truck tubes	lb.	.07¼
Black truck tubes	lb.	.06½
Buffings	ton	35.00
Bicycle tires	ton	15.00
Air bags and water bags	ton	15.00
Boots and shoes	ton	33.00

Tire Fabrics

The situation in the tire fabric field remains unchanged, with practically no demand for such fabrics. Consequently, prices are nominal and in many quarters are not even being quoted. The prices shown below are those which were in force on or about January 15, 1942.

(Prices Net at the Mill)

Peeler, carded, 23/5/3	lb.	.43½ @	.44
Peeler, carded, 23/4/3	lb.	.44½ @	.45
Peeler, carded, 15/3/3	lb.	.41½ @	.42
Peeler, carded, 15/4/2	lb.	.41½ @	.42
Peeler, carded, 13/3/3	lb.	.40½ @	.41
CHAFERS			
Carded, American, 1 1/16"	lb.	.43½ @	.44
Carded, American, 1"	lb.	.39½ @	.48

Sheetings

48x40	36 in.	5.50	lb.	—	@ 7.818
40x40	36 in.	6.15	lb.	—	@ 6.991
40x36	36 in.	6.50	lb.	—	@ 6.615
48x48	40 in.	2.50	lb.	—	@16.200
48x48	40 in.	2.85	lb.	—	@14.210
56x60	40 in.	3.60	lb.	—	@11.944
48x44	40 in.	3.75	lb.	—	@11.066

Note: Prices shown above are ceiling prices set by order of the O.P.A. Quotations are based on an average price of 15-16-inch middling cotton of 20.37c at the ten designated southern markets.

Cotton

The price of middling uplands on the Cotton Exchange has moved in the comparatively narrow range of 48 points since our last report, although the market has been quite dynamic. High for the period was 22.81 on July 11; low was 22.33 on June 13. The average price for middling uplands for the month of June was 22.31, based on 26 trading days. Reports on the favorable acceptance of the pending price control bill drove the price up steadily from 22.33 on June 13 to 22.63 on June 21. Passage of the bill, which raises the loan to 92½ per cent and provides for higher ceilings for goods based on parity or the highest price prevailing between January 1 and September 15, 1942, on June 20 brought the highest prices in sixteen years, the spot price jumping 28 points, from 22.49 on June 20 to 22.77 on June 22. Commission selling and liquidation resulted in a downward movement for several days, but a surge of heavy selling in the first few days of July brought the price back strong to 22.71 on July 5. Renewed liquidation and hedge selling in the past few days has again broken the upward trend, and a sharp drop to 22.43 was registered today (July 17). Present acreage and condition statements indicate the possibility of a short production of cotton this season. Quotations for middling uplands on the Exchange (new contract) follow:

	June 15	July 17		
	Close	High	Low	Close
October	20.61	21.78	21.61	21.64
December	20.34	21.63	21.43	21.47
March	20.09	21.52	21.30	21.34

Reclaimed Rubber

A slight decline in the demand for reclaimed rubber has been reported for recent weeks, attributable largely to easing up of restrictions on the consumption of GR-S. Statistics recently made available reveal that 106.5 pounds of reclaim were used in 1943 for every 100 pounds of natural and synthetic rubber, as compared with 29.3 pounds of reclaim for every 100 pounds of natural rubber during 1940. Supplies continue to be adequate, and the industry is prepared to meet any unexpected demand. Prices shown below are ceilings on typical grades of reclaim:

Shoe				
Unwashed	lb.	.07	@	.07¼
Tube				
Black Tube	lb.	.11¼	@	.11½
Red Tube	lb.	.12	@	.12¼
Tires				
Black (acid process)	lb.	.07½	@	.07¾
Black, selected tires	lb.	.06½	@	.06¾
Truck, Heavy Gravity	lb.	.08½	@	.08¾
Miscellaneous				
Mechanical blends	lb.	.04½	@	.05½
White	lb.	.13	@	.13¼

Ducks

Enameling (single filling)	lb.	—	@	.44¼
Belting and Hose	lb.	—	@	.39
Single filling, A grade	lb.	—	@	.19¾
Double filling, A grade	lb.	—	@	.20¾

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Organic			
A-1 (Thiocarbanilid)	lb.	.28 @	.33
A-10	lb.	.36 @	.42
A-19	lb.	.52 @	.65
A-32	lb.	.60 @	.70
A-77	lb.	.42 @	.55
A-100	lb.	.42 @	.55
Aldehyde ammonia, crystals	lb.	.65 @	.70
Altax	lb.	.39 @	.41
Beutene	lb.	.59 @	.64
B-J-F	lb.	.38 @	.43
Butasan	lb.	— @	1.13
Butyl Zimate	lb.	— @	1.13
Captax	lb.	.34 @	.36
Crylene	lb.	.40 @	.47
Di-Ortho-Tolyguanidine	lb.	.44 @	.46
Diphenylguanidine	lb.	.35 @	.36
El-Sixty	lb.	.40 @	.47
Ethasan	lb.	— @	1.13
Ethyl Zimete	lb.	— @	1.13
Ethylidine aniline	lb.	.42 @	.43
Formaldehyde aniline	lb.	.31 @	—
Guantal	lb.	.39 @	.48
Hepteen	lb.	.34 @	.39
Hexamethylenetetramine	lb.	.33 @	—
Lead Oleate, No. 999	lb.	.13 @	—
Witco	lb.	.15 @	—
Ledate	lb.	— @	1.48
Methasan	lb.	— @	1.23
Methyl Tuads	lb.	— @	1.53
Methyl Zimate	lb.	— @	1.23
Monex	lb.	— @	1.53
Pentex	lb.	.74 @	.84
Phenex	lb.	.49 @	.54
Pip-Pip	lb.	— @	1.63
R & H 50-D	lb.	.42 @	.43
R-2 Crystals	lb.	— @	1.55
Rotax	lb.	.44 @	.46
Safex	lb.	1.15 @	1.25
Santocure	lb.	.60 @	.67
Selenac	lb.	— @	1.98
SPDX-G	lb.	.53 @	.58
Super-Sulfur No. 2	lb.	.13 @	.15
Thiocarbanilid, drums	lb.	.28 @	.33
Thiofide	lb.	.43 @	.50
Thiotax	lb.	.38 @	.45
Thiurad	lb.	— @	1.53
Trimene	lb.	.54 @	.64
base	lb.	1.03 @	1.18
Triphenylguanidine	lb.	.45 @	—
Ulto	lb.	.99 @	1.04
Ureka	lb.	.50 @	.57
Blend B	lb.	.50 @	.57
Blend C	lb.	.48 @	.55
Vulcanex	lb.	.42 @	.43
Vulcanol	lb.	.85 @	—
Inorganic			
Litharge, domestic	lb.	.07 @	.07½
Magnesia, calcined, heavy	lb.	.04 @	—

COLORS

Blues [b]			
Prussian	lb.	.36 @	—
Ultramarine	lb.	.17 @	.27
Browns [b]			
Mapico	lb.	.1135 @	—
Umber, Turkey	lb.	.04¼ @	—
Greens [b]			
Chrome	lb.	— @	.25
Guignet's Green	lb.	.70 @	—
Reds			
Antimony			
crimson, 15/17	lb.	— @	—
sulfur, free	lb.	— @	—
Indian	lb.	.08¼ @	—
Domestic (Maroon)	lb.	.11 @	—
Mapico	lb.	.096 @	—
Red oxide, pure	lb.	.10 @	.12
Rub-Er-Red	lb.	.09¼ @	—
Whites [b]			
Cryptone No. 19	lb.	.0560 @	.0585
Cryptone CB No. 21	lb.	.0560 @	.0585
Cryptone ZS-800	lb.	.0825 @	.0850
Lithopone:			
Albalith	lb.	.04¼ @	.04½
Astrolith	lb.	.04¼ @	.04½
Azolith	lb.	.04¼ @	.04½
Ray-cal	lb.	.05½ @	.05¾
Rayox	lb.	.14½ @	.15¾
Titanox A	lb.	.14½ @	.14¾
Titanox B	lb.	.05¾ @	.06
Titanox C	lb.	.05½ @	.05¾
Zinc Oxide—American Process [b]			
American Azo:			
ZZZ (lead free)	lb.	.07¼ @	.07½
Anaconda, lead free	lb.	.07¼ @	.07½
Horsehead Lead Free Brand:			
Special—3	lb.	.07¼ @	.07½
XX Red—4	lb.	.07¼ @	.07½
XX Red—72	lb.	.07¼ @	.07½
XX Red—103	lb.	.07¼ @	.07½
Kadox, black label—15	lb.	.07¼ @	.07½
Red label—17	lb.	.07¼ @	.07½
St. Joe, black label	lb.	.07¼ @	.07½
green label	lb.	.07¼ @	.07½
red label	lb.	.07¼ @	.07½
U. S. P.—7, bbls.	lb.	.10½ @	.10¾

[a] Price Ceilings.
[b] Price Suggestions or Agreements.

Zinc Oxide—French Process: [b]			
Florence White Seal—7 bbl.	lb.	.09½ @	.09¾
Green seal—8	lb.	.09 @	.09¼
Red seal—9	lb.	.08½ @	.08¾
Yellows [b]			
Cadmolith	lb.	.55 @	.60
Chrome	lb.	— @	.50
Mapico	lb.	.071 @	—

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Arrow Compact		.0355 @	—
Atlantic		.0355 @	—
Certified		.0355 @	—
Certified Spheron		.0355 @	—
Channel "S"		.12 @	—
Continental		.0355 @	—
Disperso		.0355 @	—
Dixiedensed		.0355 @	—
Dixiedensed 66		.0355 @	—
Excello		.0355 @	—
Furnex		.03½ @	.06
Furnex Beads		.03½ @	.06
Gastex		.03½ @	.06
Kosmobile		.0355 @	—
Kosmobile 66		.0355 @	—
Kosmos-Dixie 20	lb.	.03½ @	.06
Micronex (Amarillo)		.0355 @	—
Micronex Beads (Amarillo)		.0355 @	—
Pelletex		.03½ @	.06
P-33		.04 @	—
Philblack A	lb.	.05 @	—
Shell Carbon (Del. Midwest)		.0240 @	—
Sterling		.035 @	—
Supreme		.0355 @	—
Thermax		.0225 @	—
Thermax "S"		.0675 @	—
Wyex		.0355 @	—

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Aluminum Flake	ton	18.00 @	24.50
99½%-300	ton	— @	16.50
86-90%-300	ton	— @	13.50
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Atomite	ton	— @	27.50
Barium carbonate (98-100%)	ton	47.00 @	49.00
Barytes	ton	25.35 @	36.00
Bentonite	ton	11.00 @	16.00
Blanc fixe, dry	ton	60.00 @	67.50
Calcene	ton	37.50 @	43.00
Catalpo (fact)	lb.	.02 @	—
Chalk, precipitated			
Suprex white	ton	32.50 @	45.00
Clay, Aerfloted, Suprex	ton	11.00 @	22.50
Aerfloted Paragon	ton	10.00 @	22.50
Champion	ton	— @	11.00
Crown	ton	— @	11.00
Dixie	ton	— @	11.00
Kaolloid	ton	— @	9.00
Langford	ton	— @	8.50
Magnolia	ton	— @	10.00
McNamee	ton	— @	10.00
Par	ton	— @	11.00
Witco	ton	10.00 @	—
Kalite No. 1	ton	— @	26.00
Kalite No. 3	ton	— @	36.00
Kalvan	ton	— @	100.00
Kalvan "S"	lb.	— @	.09½
Keystone white	ton	— @	14.00
Magnesium carbonate	lb.	.06¼ @	—
Mineralite	ton	— @	30.00
Pyrax A	ton	— @	7.90
Rottenstone (powd. Dom.)	ton	25.50 @	37.50
Rubberol	lb.	— @	.17½
Silene EF (calcium silicate)	lb.	.055 @	.06
Snowflake white	ton	— @	16.00
Talc, domestic	ton	17.00 @	25.00
Whiting, commercial	ton	16.00 @	26.00
Witco	ton	6.00 @	—
Witcal	ton	— @	100.00
Witcarb R-12	ton	— @	40.00
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Aromatics—Rodo #0	lb.	4.00 @	4.50
Rodo #10	lb.	5.00 @	5.50
Curodex 19	lb.	2.75 @	—
Curodex 188	lb.	3.50 @	—
Curodex 198	lb.	4.50 @	—
Para-Dors	lb.	4.50 @	—
Arresklene No. 375	lb.	.35 @	.50
Darvan (dispersing agent)	lb.	.30 @	.34
Santomerse S	lb.	.11 @	.25
Sponge Paste	lb.	— @	.18
Sunproof	lb.	.22¾ @	.27¾
Tonox	lb.	.50 @	.59
Ty-Ply	gal.	6.75 @	8.00
Unicel (blowing agent)	lb.	.50 @	—

SOFTENERS

Acids			
Acetic, 28%, bbls.[a]	100 lb.	3.38 @	3.63
Nitric, 36 degrees	cwt.	5.00 @	—
Acids, Fatty			
Laurex	lb.	.14¼ @	.17¼
SL-20	lb.	.11 @	.13
Stearex Beads	lb.	.10 @	.11
Stearite	lb.	.10 @	—

Alkalies			
Caustic Soda, 76%	cwt.	2.70 @	5.70
Soda Ash, 58%	cwt.	1.15 @	2.98
Oils			
Degras, bbls.	lb.	.10 @	.12
Para-Flux	gal.	.17 @	.18
Para-Lube	lb.	.046 @	.048
Petrolatum, amber [b]	lb.	.03½ @	—
Pigmentaroil, tank cars	gal.	.20½ @	—
in drums	gal.	.26½ @	.27½
Pine, tanks	gal.	.55 @	—
Rosin Oil, cmpd.	gal.	.40 @	—
Rubberol	lb.	.13½ @	.14
Rubtack	lb.	.10 @	—
Seedine, c.l.	lb.	.07¼ @	—
Witco Palm Oil	lb.	— @	—
Witco Softener No. 20	gal.	.20 @	—
Woburn No. 8, c.l.	lb.	.06 @	—
Resins and Pitches			
Pitch, Burgundy	lb.	.06 @	—
coal tar	ton	19.00 @	22.00
hardwood	ton	16.00 @	22.50
pine, 200 lb. gr. wt.	bbl.	— @	4.50
Pigmentar, tank cars	gal.	.20½ @	—
in drums	gal.	.26½ @	.27½
Retort Pine Tar, drums	gal.	.26½ @	.27½
Solvents			
Acetone, pure [a]	lb.	.07 @	—
Benzene, 90%, tank car	gal.	.14 @	—
Beta-Trichlorethane	gal.	— @	.20
Bondogen	lb.	.98 @	1.05
Carbon, bisulfide	lb.	05 @	.08½
Carbon tetrachloride	gal.	.83 @	1.27
Dichlorethylene	lb.	— @	—
Dipentene, cml., drums	gal.	.48 @	.50
Ethylene dichloride	lb.	.07½ @	.08½
Plastogen	lb.	.07¾ @	.08
Reogen (drums)	lb.	.11½ @	.12
Rub-Sol	gal.	.09½ @	—
Trichlorethylene	lb.	.08 @	.09½
Turpentine, spirits	lb.	.78½ @	—
dest. dist., drums	gal.	.50 @	.55
Waxes			
Beeswax, white [b]	lb.	.58 @	—
Carnauba, yellow [b]	lb.	.83½ @	—
Ceresin, white, dom.	lb.	.13½ @	.15
Montan, crude	lb.	— @	—
Paraffin [a]			
Yellow crude scale, 124/126	lb.	.04¼ @	—
Refined, 123/125	lb.	.05¼ @	—

ANTI-OXIDANTS

Agerite Alba	lb.	1.95 @	2.05
Gel	lb.	.52 @	.54
Hipar	lb.	.61 @	.63
Powder	lb.	.43 @	.45
Resin	lb.	.43 @	.45
Resin D	lb.	.43 @	.45
White	lb.	1.23 @	1.33
Albasan	lb.	.69 @	.74
Antox	lb.	.54 @	.56
B-L-E	lb.	.43 @	.52
Flectol H	lb.	.43 @	.55
Flectol White	lb.	.89 @	1.00
Neozone A, B, C, D, E	lb.	.43 @	.63
Oxynone	lb.	.77 @	.90
Retardex	lb.	.44½ @	.47½
Santoflex B	lb.	.43 @	.55
Santoflex BX	lb.	.54 @	.64
Santovar O	lb.	1.15 @	1.40
S.C.R.	lb.	.32 @	.34
Stabilite	lb.	.48 @	.50
Stabilite Alba	lb.	.69 @	.74
VGB	lb.	.43 @	.52

EXTENDERS

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Vanzak	gal.	.05 @	.06

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Cocoa Soapstock	lb.	.06 @	.08
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Dipex	lb.	.06 @	.08
Glycerized Liquid Lubricant	gal.	— @	1.35
Lubrex	lb.	.25 @	.30
Mineralite	ton	— @	30.00
Sericite	ton	65.00 @	75.00
Soap Tree Bark, cut, sifted	lb.	.06 @	.08

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Black	lb.	.08½ @	.13
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Brown	lb.	.10 @	.14
Neophax A	lb.	.16½ @	—

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Dispersed Sulfur No. 2	lb.	.08 @	.12
Sulfur Chloride, yellow (drs.)	lb.	.03 @	.08
Sulfur, rubber makers			
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Telloy	lb.	1.75 @	—
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ASPHALTUMS
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*CHAMPION
*MAGNOLIA
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Coumarone Resins
Resinous Oils
Reclaiming Oils
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Dispersing Oils
Softeners
Solvents
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COLLOIDAL SULPHUR
COLLOIDAL ZINC OXIDE
COLLOIDAL COLORS
HEVEATEX CORPORATION
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Offices in New York, Akron, Chicago

The Market Place

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Chemicals and Compounding Materials {continued}

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For All Cures
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Accelerators
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Plasticizers
Dispersions
Pigments
Clays
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Aromatics
Blacks
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A neutral gum for synthetic rubber compounding. *Laboratory test data, samples and prices on request.*
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DU PONT Rubber Chemicals
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DU PONT ANTI-OXIDANTS
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RUBBER CHEMICALS DIVISION
WILMINGTON, DELAWARE

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Special Process Reinforcing BLACK. Superior aging and oil resistant properties. Low permanent set.
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General Atlas Carbon
Pampa, Texas

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EASTON, PA.

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Carbonate of Magnesia—precipitated
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Also Light, Medium and Heavy types
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Its *White, Pure* and *Uniform*
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"Orvus" enables articles to leave molds readily; molds clean easily. Effective in hardest water. Also acts as thorough cleanser for molded and extruded rubber goods.
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General Sales Agents for
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Philadelphia Pennsylvania

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Burgundy Pitch
"Galex" — a non-oxidizing Resin
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Chemicals and Compounding Materials (continued)

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The XX Reds Kadox
ZINC SULPHIDE PIGMENTS
The Cryptones The Albaliths (Lithopones)
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STEAREX . . . CAKE or POWDER
STEAREX BEADS
Standardized Products for Rubber Compounding
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SOAPSTONE
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lead free—pure—uniform—dependable
AZO ZZZ-11 AZO ZZZ-55
AZO ZZZ-22 AZO ZZZ-44 AZO ZZZ-66
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HIGH ECONOMY
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For All Purposes
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For extreme resistance to heat, abrasion, oil, gasoline, aging, and deterioration.
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Long Life
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Norwalk, Connecticut

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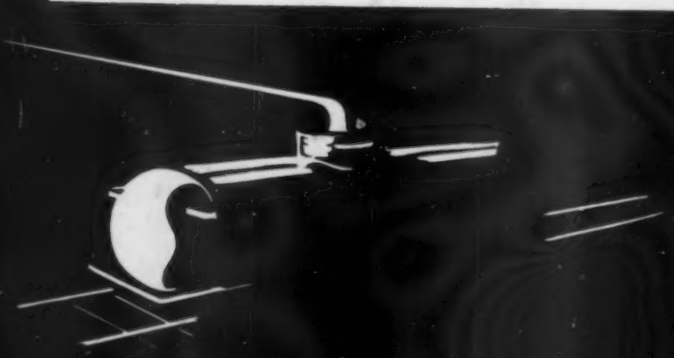

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